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PRINCIPAL CONTENTS

	Page
Features	
Leader: Hatching Out	103
Conference Paper Authors	104
Correspondence	112
Book Reviews	118
House Organs	124
Technical	
Effects of Mould Resistance on Internal Stress in Sand Castings, by R. N. Parkins and A. Cowan	105
Operating Experiences with Hot-blast Cupolas in Great Britain, by F. C. Evans	113
Another Hot-blast Cupola Plant	119
Dust Control on Floor Grinders	123
News	
I.B.F. Works Visits Day	104
Employees' Shareholding	118
Changed Name and Address Only	118
Parliamentary	126
News in Brief	130
Personal	132
Raw Material Markets	134
Obituary (Advert. section)	29
Statistics	
Steel Output Record for June	126
Pig-iron and Steel Production	128
Current Prices of Iron, Steel and Non-ferrous Metals (Advert. Section)	28

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Hatching Out

It is all to the good of the new shell-moulding process that the industry now finds itself in a position to discuss the difficulties which are inimical to any new development. When a new method of manufacture is introduced, it is normal for its advantages to be stressed and it is only with the passage of time that the difficulties, snags and drawbacks reveal themselves. When they do appear, the pessimists are inclined to exaggerate their importance instead of seeking means for overcoming them. The cure for some of the difficulties so far enunciated with shell moulding are obviously much more simple than those which have beset the foundry industry since its age-dimmed inception.

The snags so far reported are mould warpage; carbon pick-up when making steel castings; flash and dimensional inaccuracy through the use of adhesions for joining the two halves of the mould together. Mould warpage not being a universal ill, is probably connected with either the curing technique or insufficient attention being paid to the method of stripping the shell from the pattern. The phenomenon of carbon pick-up by mild steel from the mould should be resolvable either by the use of steel of lower carbon content or the application of some sort of mould dressing. It has been said that, where castings of heavier section have been tried out, the trouble is minimized. There are a considerable number of methods used for assembling the two half-moulds and the difficulty to be associated with adhesions is dealt with by Mr. James H. Smith in his "C. E. Hoyt Lecture" to the annual meeting of the American Foundrymen's Society. He states: "The operator places the drag half on the glueing fixture, and the cope half is placed on the holder which knocks out the top of the pouring sprue. He positions the resin container which vibrates dry resin on to the shell [drag] and then places the cope half on to the drag half and touches the controls, which automatically move the squeeze head of the glueing machine into position. The machine presses the two halves together for a predetermined length of time sufficient to assure a firmly-bonded complete shell."

As for the future, there are propositions afield to "blow" an oil-sand mixture between a metal pattern and a contoured drier—the "D" Process. Thereby, after cooking the half-mould on the drier, there is produced a thicker shell than with the synthetic-resin process—and one well capable of withstanding the pressure of the metal. Actually, we are aware that this process has been used for several years in this country. Then, there is another new moulding technique whereby moulds are squeezed at pressures reaching 500 lb. per sq. in. instead of the conventional 50 lb. or less. The mixture used is silica sand with a modicum of resin. The process is said to yield "smooth and accurate castings." The movements now deemed necessary for shell moulding need simplification and reduction before finality—if attainable—can be reached. The two pressing problems — the cost of patternplates and the bonding material—must receive constant attention and unremitting research.

I.B.F. National Works Visits

Arrangements for October 2 in East Midlands

In view of the outstanding success of the three previous annual national works visits days, the Council of the Institute of British Foundrymen now regards this development as a permanent feature of the Institute's activities, and has accepted the offer of the East Midlands branch to make the arrangements for the 1953 event. These works visits supplement the arrangements which are already made by branches and those afforded at the annual conferences, and in particular enable those members who cannot spare the time to attend the whole of the annual conference to take part in an annual national gathering. It is hoped that other branches will assume responsibility for arrangements in future years. In the present instance, the Council is indebted to the East Midlands branch and especially to its secretary, Mr. S. A. Horton, for undertaking this work.

Programme

The visits will take place on Friday, October 2, 1953, when a large number of important foundries in the East Midlands area have kindly agreed to receive parties of members (see Table I). Two of the visits will be for the full day, and five will consist of a visit in the morning and a visit in the afternoon, luncheon being provided at midday. Members are asked to indicate on a reply form which visit or group of visits they wish to attend and, as the number permitted to attend any particular visit in most cases is strictly limited, their second and third choices. In the evening, at 7.30 p.m., there will be a dinner at the Regent Restaurant (lower floor, Palais de Dance); entrance King Edward Street, Nottingham.

All coaches for the visits will leave from Huntingdon Street 'bus station, Nottingham, and the times at which the coaches will start for the various visits are for visits "D," "E," "F," 9.0 a.m.; visits "A," "B," 9.15 a.m.; visit "C," 9.30 a.m.; and visit "G," 11.0 a.m. All coaches are expected to return to Nottingham not later than 6.30 p.m. The charge for each group of works visits, including transport by coach, luncheon, gratuities and administrative expenses is £1 and the additional charge for the dinner is 17s. 6d.

Members who desire to participate are requested to return the reply form to the Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, 3, not later than Tuesday, September 1. Those participating are requested to make their own arrangements for hotel accommodation. They are advised to book at the earliest possible moment, and in any case not later than August 31.

TABLE I.—*Programme of Works to be Visited by Invitation of Directors and Managers.*

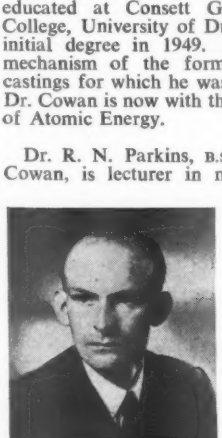
Party.	Morning visit.	Afternoon visit.
A.	Ley's Malleable Castings Company, Limited, Derby, malleable ironfounders.	Qualcast, Limited, Derby, light repetition ironfounders.
B.	Ley's Malleable Castings Company, Limited, Derby, malleable ironfounders.	Herbert Morris, Limited, Loughborough, mechanized grey ironfounders and crane manufacturers.
C.	Stanton Ironworks Company, Limited, Nr. Nottingham, mechanized foundry and spun-pipe plants (all-day visit).	—
D.	Bamfords, Limited, Uttoxeter, makers of farm machinery and engineers.	Lloyds (Burton), Limited, Burton-on-Trent, iron and steel founders.
E.	S. Russell & Sons, Limited, Leicester, mechanised and jobbing grey and alloy ironfounders.	Stanton Ironworks Company Limited, Melton Mowbray, mechanized foundry and ingot-mould foundry.
F.	G. Perry & Sons, Limited, Leicester, master patternmakers.	Stanton Ironworks Company Limited, Melton Mowbray, mechanized foundry and ingot-mould foundry.
G.	Butterley Company, Limited, Butterley, general heavy engineers and ironfounders. (all-day visit).	—

(*Continued at foot of col.* 2)

Conference Paper Authors

Dr. A. Cowan, B.SC., joint Author of the paper "Some Effects of Mould Resistance on Internal Stress in Sand Castings," printed on the adjoining pages, was educated at Consett Grammar School and King's College, University of Durham, where he obtained his initial degree in 1949. Subsequently he studied the mechanism of the formation of residual stresses in castings for which he was awarded the degree of Ph.D. Dr. Cowan is now with the Ministry of Supply, Division of Atomic Energy.

Dr. R. N. Parkins, B.SC., A.I.M, co-Author with Dr. Cowan, is lecturer in metallurgy at King's College, University of Durham, Newcastle-upon-Tyne. Dr. Parkins was educated at King James I Grammar School, Bishop Auckland, and King's College, University of Durham. He graduated with first-class honours in metallurgy and was awarded the Saville Shaw Memorial medal of the Society of Chemical Industry in 1947. He took up his present appointment in that year and for his subsequent work on the stress corrosion of mild steels was awarded the degree of Ph.D.



J.I.C. Convention & Banquet

Tentative arrangements are already being made for the Coronation year convention and banquet of the Joint Iron Council. In the course of the next three or four weeks detailed particulars will be announced. The Minister of Supply, Mr. Duncan Sandys, has accepted an invitation to be the principal guest and will join members and their guests at the Dorchester Hotel, Park Lane, London, W.1, on Tuesday, November 3. Representatives are therefore earnestly requested to book the date now, both for the convention itself (to be held at the Café Royal, Regent Street, London, W.1, in the morning and afternoon of November 3) and the banquet in the evening.

At the convention the morning will be devoted to the annual general meeting of the Joint Iron Council, and the afternoon to a discussion on the rising costs of employers' liability insurance and their inter-relation with the question of safety in the industry.

APPROXIMATELY £6,568,000 is to be raised from issues of ordinary shares and debenture stock by the English Electric Company, Limited. The need for further permanent finance is due to rising output of both normal products and work for the defence programme.

Effects of Mould Resistance on Internal Stress in Sand Castings*

By R. N. Parkins, B.Sc., Ph.D., A.I.M. and A. Cowan, B.Sc., Ph.D.

Measurements on castings of simple shape indicate that the surrounding mould material may offer considerable restraint to the contraction of the casting as it cools, and that the degree of restraint is, in general, related to the high-temperature strength of the sand. It is inferred from this result, that the frequent suggestion that the mechanical properties of the mould have little influence upon the formation of residual stresses is not always true, depending upon the shape of the casting and the alloy concerned. Indeed, it is shown in an Appendix that the stress remaining in a cast rectangular framework can be controlled to some extent by the use of a facing sand, on various parts of the casting, having a grain-size distribution resulting in close packing of the grains.

It is well known that in castings of certain design the contraction which the metal undergoes as it cools may be hindered by the surrounding sand. In extreme cases, if the amount of hindrance is high at elevated temperatures, hot-tearing of the metal ensues; in other cases internal stresses will develop in the casting. The latter may be relieved when the casting is removed from the mould, but if the amount of hindrance has varied throughout the casting and has been sufficiently high to cause plastic deformation, stresses will remain in the casting even when the restraining force, in the form of the sand, is removed. Residual stresses can, of course, arise through other agencies, *i.e.*, temperature differences in various parts of the casting and the volume changes accompanying phase transformations[1]; the effect of these on the magnitude of the stress may well be greater than the contribution from the mould, but it is clear that in some cases at least the latter will be appreciable. If any attempt has to be made to determine the relative effects of these three factors in the formation of residual stresses it is obviously desirable, as far as is possible, to conduct experiments so that only one of these variables is operative at any one time. The present work was performed for the purpose of studying the effect of the sand in hindering the contraction of the metal.

* Paper presented to the Institute of British Foundrymen in Blackpool at its fiftieth annual meeting.

EXPERIMENTAL METHOD

Casting Design

Since, in castings of small and uniform cross-section, appreciable temperature gradients will be absent, it merely remains to arrange the shape of the casting so that its contraction on cooling is hindered by the adjacent sand if this aspect of residual stress formation alone is to be studied. Two such castings have been used in the present work; one consisting of a straight bar with flanges at each end, the other being a thin-walled, hollow cylinder. The only hindrance to free contraction was provided by the sand between the flanges and the core of the cylinder respectively.

Since the stresses which form in castings of this

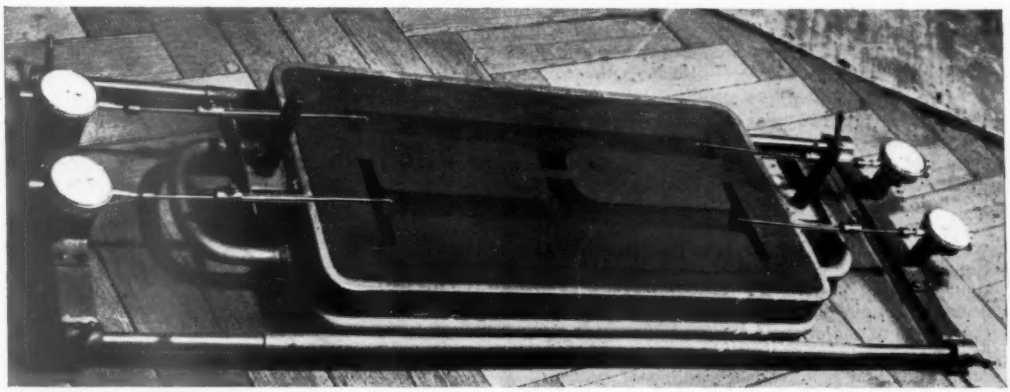


FIG. 1.—*Moulding-box Assembly for Flanged-bar Casting with Cope Half Removed to show Method of Measuring Contraction.*

FIG. 2.—*Cross-section through Moulding Box showing Moulding Technique for Hollow Cylinders.*

type are released when the casting is removed from the mould, the measurement of the magnitude of the stress presents some difficulty. In the double-flanged bar, this has been overcome by comparing its length with that of a uniform, straight bar of identical length and section, cast side by side through a common runner basin, as shown in Fig. 1. The difference in length of the straight and flanged bars at any one temperature is indicative of the hindrance offered to contraction by the sand between the flanges. The bars were 1.128 in. dia. and 16 in. long; flanges 4 in. dia. and $\frac{1}{8}$ in. wide, tapering to $\frac{1}{4}$ in. at the circumference, were found to cool quickly and were relatively strong and hence not liable to undergo deformation when subjected to the strain of the sand. The common pouring basin fed two separate downgates, the ingates of semi-circular section also being separate, and located in the drag-half of the box in order to lower the temperature of the hot-spots at the junction with the bars. Thus contraction of the cast bars proceeded from each end towards the central downgates. Contraction was measured by means of dial gauges in contact with thin, mild-steel prongs cast-in at both ends of each bar. Thermocouples were embedded in the sand during moulding and the surface temperatures at the mid point along each bar were measured during cooling.

In designing the thin-walled hollow cylinders it was found necessary, as a result of preliminary experiments on thicker castings, to make these of 7 in. int. dia., 4 in. long and $\frac{1}{4}$ in. wall-thickness. The core was moulded from the drag-half of the box and extended the full length of the cylinder, while the normal parting line was used for the outer walls, as shown in Fig. 2. The extremely thin section necessitated using only dry-sand moulds and pouring temperatures in considerable excess of those normally employed. A thermocouple was placed at the centre of the core during the moulding, for the purpose of determining the maximum temperature reached at that point during cooling of the casting. Cylinder castings were removed from the mould box with the sand core in position and the internal stresses were released by knocking out the core and slitting the cylinder parallel to its longitudinal axis. The change in strain during these operations was measured by means of electrical-resistance strain-gauges.

Sand Control

In order to obtain as high a degree of reproducibility as possible in the test results, routine sand-control tests, *i.e.*, mould hardness, moisture and permeability, were employed throughout. As it was desired to measure hot-strengths as well as green-strengths, the B.C.I.R.A. test-piece (of a lower cross-sectional area than that of the A.F.S. and thus capable of attaining a uniform temperature more readily on heating) was used for all the compression tests. For dry- and hot-strength measurements, the test specimens were dried at 200 deg. C. The hot-compression strength determinations were made in a hydraulic machine modified to a similar design to that used by Davies and Rees.[2] Each test specimen was "soaked" at the temperature of testing for 30 min. before fracturing.

Although no attempt was made to study the effect of specific moulding sands, representative samples of naturally-bonded sand, synthetic sand and core-sand were studied. To make the effect of sand strength more pronounced, a dried floor-sand, having varying initial moisture content and hence appreciably differing dry-strengths, was used. Addition of sawdust caused further lowering of the sand strength due to the charring of this material at high temperatures. To achieve greater clarity in discussion, the sands have been designated by their initial letter followed by a number relating to their compression strength, as shown in Table I.

Melting, Casting and Properties of Metals

The castings were made in grey cast iron, brass and "Y" alloy, these alloys being chosen as representative of the ranges of contraction, temperature and properties commonly found in practice. Their chemical compositions (per cent.) were:—Grey cast

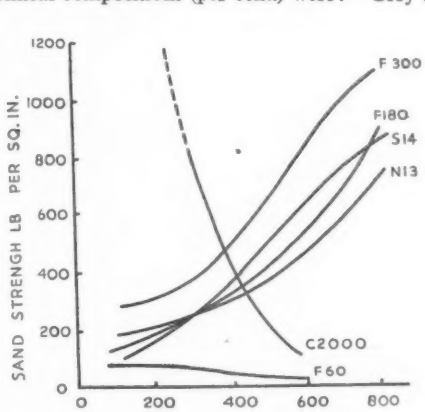


FIG. 3.—*High-temperature Compression Strengths of Moulding Sands*

iron: T.C. 3.01, Si 1.90 Mn 0.86, P 0.18, and S 0.04; brass: Cu 66, Zn 34, and "Y" alloy: Cu 4, Ni 2.5, Mg 1.5, and Al to 100 per cent. Melting was carried out in a gas-fired crucible furnace according to the usual practice, *i.e.*, with additions for melting losses, fluxes where appropriate and degassing treatment for the aluminium alloy. The casting temperature chosen varied according to the casting but was kept constant for any one series of experiments.

The mechanical properties of the cast iron, brass and "Y" alloy were determined at room temperature and at elevated temperatures, since the maximum amount of internal stress at any temperature is governed by the yield point of the alloy at that temperature. The test specimens were machined from bars of 1½ in. dia. in the as-cast condition. The high-temperature tensile tests were carried out on a 5-ton creep testing machine, after the specimen had soaked at the testing temperature for 30 min. The yield stress and the modulus were determined, the accuracy of measuring decreasing at the high temperatures of testing. The yield stress, which was poorly defined, was taken as that stress at which rapid plastic deformation took place as opposed to slow steady creep.

RESULTS

Sand Tests

The values of the compressive strengths at room temperature of the moulding sands are shown in Table I, while the results of the hot compression tests are shown in Fig. 3. The tests were not carried out at temperatures in excess of 800 deg. C., since measurements on castings showed that only a small amount of sand surrounding the metal exceeded this temperature even when casting the ferrous metals. The curves for sands N13, S14, F300 and F180 show a similar relationship between strength and temperature to those obtained for like sands by Davies and Rees.[2] The sawdust of sand F60 gradually charred as the temperature of testing was increased, thus leaving voids in the test-piece and causing the strength to diminish to a value of approximately 15 lb. per sq. in. at 600 deg. C. At a temperature of 250 deg. C., the linseed oil of sand C2,000 commenced to char, the compression strength rapidly diminishing as the temperature was increased. At temperatures in excess of 600 deg. C., complete charring had occurred throughout the test-specimen during the standard soaking time, with the result that the strength had so low a value that it couldn't

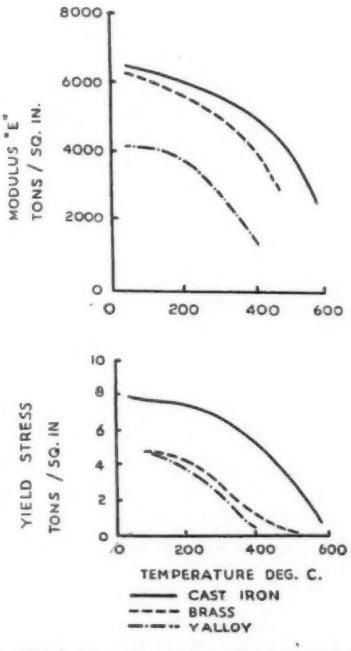


FIG. 4.—*Variation of the Tensile Properties of the Alloys with Temperature.*

be measured. The values obtained from these high-temperature compression tests were not used quantitatively, but served to show the general effect of an increase in temperature on sand strength.

In connection with the experiments on hollow cylinders, room-temperature compression tests were carried out on the three dry sands, F300, F180 and F60, after heating to temperatures up to 800 deg. C., then cooling to room temperature. The results of these tests are shown in Table II, where it will be seen that heating to temperatures of the order of 600 deg. C. had little effect upon the strength at room temperature, whereas a marked drop in strength was observed after cooling from 800 deg. C.

Mechanical Properties of the Metals

The results of the tests to determine the mechanical properties of the metals at room temperature

TABLE I.—*Sands Used in the Experiments.*

Designation.	Sand type.	Composition of sand mix.	Condition.	Compression strength, lb. per sq. in.
N.13	Naturally-bonded	Northallerton sand and 5 per cent. moisture	"Green"	13
S.14	Synthetic	Southport sand and 5 per cent. bentonite and 3 per cent moisture	"Green"	14
C.2,000	Core	Southport sand and 2 per cent. cereal bond and 3 per cent. linseed oil and 3 per cent. moisture	Baked at 220 deg. C. for one hour	2,000
F.300	Floor	Floor sand and 10 per cent. moisture	Dried at 200 deg. C.	300
F.180	Floor	Floor sand and 5 per cent. moisture	Dried at 200 deg. C.	180
F.60	Floor	Floor sand and 5 per cent sawdust and 5 per cent. moisture	Dried at 200 deg. C.	60
F.13	Floor	Floor sand and 5 per cent. moisture	"Green"	13

FIG. 5.—*Development of Plastic Deformation in Cast Iron in Sand F* 300.

and at elevated temperatures are shown in Table III and Fig. 4 respectively. These results resemble those quoted in the literature for alloys of similar composition. The reduction in the value of the yield

TABLE II.—*Effect of Pre-heating on the Room-temperature Strengths of Three Sands.*

Sand designation.	Temperature cooled from (deg. C.).	Compression strength (lb. per sq. in.).
F.300	800	80
	600	270
	400	300
F.180	800	50
	600	160
	400	160
F.60	800	0
	600	5
	400	30

stress and Young's Modulus would be expected to continue above the temperature of testing until a zero value is attained when the solidus is approached. The curves of Fig. 4 indicate that, at temperatures above 650, 550 and 420 deg. C. for cast iron, brass and "Y" alloy respectively, appreciable stresses cannot exist due to the low value of the yield stress.

Experiments on Flanged Bars

Contraction curves obtained during the cooling of the straight and flanged bars showed that the restraint of the sand became effective as soon as measurement was possible. Both bars contracted uniformly, the difference in contraction being solely due to the resistance of the sand between the flanges. Fig. 5, which is typical of all the results obtained, shows that this difference gradually increased to a maximum, then became constant, the temperature at which this occurred being dependent upon the alloy used and almost unaffected by the sand. The value of this temperature approximated to 650, 500 and 400 deg. C. for cast iron, brass and "Y" alloy respectively. These temperatures are those measured at the surface of each bar at the centre of its length and are, therefore, lower than the average temperature of the bar. Thus the actual temperatures

TABLE III.—*Tensile Properties at Room Temperature.*

—	Yield stress, tons per sq. in.	U.T.S., tons per sq. in.	"E," tons per sq. in.
Cast iron	8.4	18.8	6,500
Brass	5.2	13.0	6,160
"Y"-alloy	5.2	11.0	4,420

will approximate to those values given previously as being the minimum at which the magnitude of the yield stress is low.

The final difference in the amount of contraction was made up of plastic deformation which the bar had undergone at high temperatures, plus the elastic strain balanced by the thrust of the sand between the flanges. As this latter quantity was so small as not to be measurable, the difference may be taken as due only to high-temperature plastic deformation. The results of the experiments carried out in this part of the work are indicated in Table IV, expressed as the difference between the percentage overall contraction of the straight and flanged bars. The majority of the tests were duplicated and a high degree of reproducibility (± 0.015) of the amount of

TABLE IV.—*Plastic Deformation in Flanged Bars.*

Moulding sand.	N.13.	S.14.	C.2,000.	F.300.	F.180.	F.60.
Cast iron ..	0.11	0.08	0.29	0.24	0.12	0.20
Brass ..	0.10	0.11	0.21	0.35	0.13	0.21
"Y"-alloy	0.12	0.14	Hot tear	Hot tear	0.22	0.15

plastic deformation was obtained. The overall solid contraction of the straight bar varied from 1.4 per cent. for "Y" alloy and 1.5 per cent. for cast iron to 1.7 per cent. for brass. Thus the contraction of the flanged bar was reduced by amounts varying from 10 to 20 per cent.

Thin-walled Hollow Cylinders

The results of tests on thin-walled hollow cylinders are shown in Table V. They were obtained on removal of the sand core, no further stress-relief occurring on slitting the cylinder so that the stress was entirely due to the hindrance to contraction provided by the core. The distribution of gauges around selected cylinders showed the circumferential stress to be uniform. No stress was found in the longitudinal direction. The thin section caused the iron to be almost completely white in fracture and hence strain values only are given. The single results quoted represent an average for three castings, the maximum variation being ± 0.1 tons per sq. in. or a strain of $\pm 1.10^{-4}$ in the case of cast iron.

A maximum temperature of 150 deg. C. was attained at the centre of the core some 30 min. after

TABLE V.—*Circumferential Tensile Stresses in Thin-walled Hollow Cylinders.*

Sand.	"Y"-alloy (stress in tons per sq. in.).	Cast iron (strain on 1 in. × 10^4).
F.300	1.9	16.0
F.180	0.8	4.6
F.60	0.2	0.0

pouring the cast iron. As rapid cooling occurred, due to the very thin section, only a very small amount of sand would be heated to over 600 deg. C. and hence the room temperature strength of the sand would be virtually unaltered.

COMMENT

The development of the plastic deformation in the flanged bar can most easily be understood by considering the relative strengths of sand and metal during the cooling process. Thus, initially, the low-strength metal will be surrounded by sand of greater average strength. Next to the bar is sand at approximately the same temperature as the metal, gradually changing to unaffected dry-sand or green-sand at a distance from the bar less than the radius of the flange. The mould wall, therefore, effectively restrain the contraction of the flanged bar. The amount of sand at each temperature is constantly changing as the bar cools, however, so that the resistance to free contraction must vary with temperature. Additionally, as the bar cools, the yield point of the metal increases, so that at some temperature (dependent upon the alloy under consideration) the metal strength will attain that of the sand and any subsequent restraint will be relieved by collapse of the sand rather than by plastic deformation of the metal.

The amount of plastic deformation in flanged bars will then be a function of the conditions existing above the temperature at which the sand and metal strengths were equal and this, in turn, will be governed by the reaction of the sand to heating. Thus, the core sand, which was used as a 2-in. facing on both the straight and flanged bars, rapidly burnt out at high temperatures, forming a layer of low-strength sand adjacent to the metal immediately after casting and initially allowing comparatively-free contraction of the flanged bar. As contraction proceeded with decreasing temperature, the extremely-high strength of the uncharred sand between the flanges, but remote from the metal, became effective in providing restraint and accounted for the large amount of deformation. The aluminium alloy, having a lower casting temperature, caused appreciably less charring, with the result that the restraint of the unaffected sand was imposed upon the metal when it was still relatively weak. This caused hot-tearing at the centre of the bar at the junction with the ingate. Hot-tearing during cooling was readily detectable since the direction of the ensuing contraction was reversed, proceeding towards the flanges and causing the dial gauge readings to remain constant. The skin temperature of the bar when hot-tearing occurred was 480 deg. C. although, as stated previously, the temperature was inaccurate when applied to the section of the bar. Thus it would appear likely that hot-tearing occurred when the majority of the bar was at a temperature approaching the solidus of the metal, the large value of the liquid/solid contraction being sufficient to allow appreciable restraint to be exerted.

The results of the tests on the dry-sands, F300, F180, are of the order to be expected from a consideration of their strengths, since the effect of temperature will be the same in both cases. Similarly, the plastic deformation of the aluminium-alloy casting in sand F60 was less than that in the two stronger sands. The results for cast iron and brass in sand F60, however, are inconsistent with this trend, which is rather difficult to explain in terms of their higher casting temperatures causing charring of the sawdust, since this would be expected to have the opposite effect to that observed. The amount of deformation occurring in all the alloys is least with the "green" sands, as would be expected from a consideration of the mechanical properties of the sands.

At any time during cooling in a thin-walled hollow cylinder, the contraction proceeds towards the central core and the stress will be dependent upon its mechanical properties and the strength of the sand aggregate at that time. Provided hot-tearing has not occurred, uniform plastic deformation of the cylinder at high temperatures will only affect its final dimensions, so that the stress at room temperature will depend only upon the room-temperature strength of the sand aggregate. It is interesting to note that the result for the iron cylinder cast into sand F60 is of the order to be expected, unlike the corresponding result for the flanged bar.

CONCLUSION

In general, the results indicate that the hindrance to the contraction of a cooling sand casting is governed by the strength characteristics of the moulding sand. The plastic deformation which results from this hindrance to contraction is cumulative over a high-temperature range and hence would not be expected to bear a simple relationship to the room-temperature sand strength. It will be dependent upon both the high-temperature sand-strength and the ability of sand remote from the casting to prevent the yielding of the hot sand. Thus, in castings subjected to internal stresses, the hot-strength of the sand and the extent to which heat is passed to the adjacent sand, will determine the contribution of the sand hindrance to the total stress. It is clear that in some castings this may be small, the principal source of stress being temperature differences in the castings, but its contribution may be considerable in several instances.

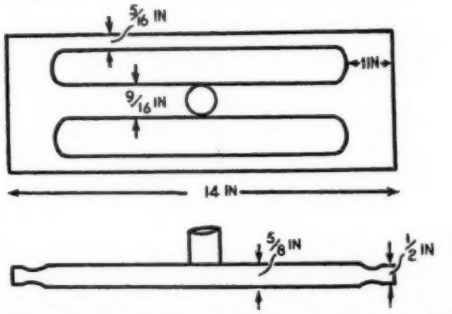


FIG. 6.—*Rectangular-type Framework Test Casting.*

APPENDIX

Experiments on the Effect of Sand Grain-size Distribution

The grain-size distribution of sand will affect its moulding density and hence its compression strength. The Southport sand used in the previous experiments had a high permeability value, representing a high percentage of pore space between the grains, while the Northallerton sand had a higher percentage of fine-grade material thus allowing less pore space. In order to obtain a more exact determination of the effect of grain-size distribution, a synthetic sand mix was used which was similar to S14, but approximated to zero percentage voids in the aggregate. Sheehan[3] has indicated that, if the sand-grains are assumed to be spherical, the proportions of each grain size necessary to occupy the maximum amount of pore space may be calculated. By making up a sand in such proportions, it was shown that "fitting-in" of the intermediate and smaller grains did in fact occur after repeated ramming, resulting in a closely-packed aggregate.

A sand mix was made up in the fractions suggested; high-silica sand was used for all the fractions other than the −100 +150 mesh, bentonite as a bonding material being included in the −200 mesh fraction. The sand was composed of:—

B.S. sieve no.	Weight (per cent.).	Sand used.
−22 + 30	74.2	Cleugh.
−60 + 72	5.2	Southport.
−100 + 150	5.5	Northallerton.
−200	15.1	10 per cent. Cleugh plus 5 per cent. bentonite plus 5 per cent. moisture.

An exceedingly plastic and well-bonded sand resulted from the synthetic constituents. That close-packing between the grains did occur was shown by the fact that the A.F.S. permeability was decreased from 102 after the three standard blows, to 11 after 50 blows. A high percentage flowability was obtained, although the length of the test-piece continued to decrease at each consecutive blow up to 50.

Experiments were made using this sand with the flanged-bar type of casting and also with a framework-type casting, shown in Fig. 6, and consisting of a central member and two outer members of equal length but smaller cross-sectional area joined at their extremities by rigid yokes. The internal stress in this type of casting is dependent upon differences in cooling rates between the limbs and also upon the hindrance to free contraction caused by sand between the limbs. The mode of formation of such internal stresses is well known and has frequently been described in the literature[1,4].

In the initial experiments on the flanged-bar castings, the "close-packed" sand was used as a facing, occupying the whole volume between the flanges, the remainder, including the facing sand on the straight bar, was of F13 sand. Cast iron, brass and "Y" alloy were cast into the "green" mould and the usual contraction curves were taken. On cooling the cast iron, the flanged bar was found to have undergone greater contraction than the straight bar. This also occurred with brass and "Y" alloy immediately after pouring but these reverted to the usual condition (flanged bar of greater length than the straight bar) as cooling proceeded. As the degree of packing produced by hand-ramming in the mould did not approach the high density possible by numerous blows on an A.F.S. test-piece, it is believed that compression of the sand between the flanges on contraction of the bar merely caused the sand grains to fit together more closely. This would result in little hindrance being offered to free contraction and account for the low deformation values given by the non-ferrous alloys. The natural grain-size distribution of sands N13 and S14 would prevent any appreciable further "fitting in" on compression, hence causing deformation of the flanged bar.

The presence of different frictional forces between the two sands and the metal has been postulated to account for the reversal of the normal order of deformation. In tests using other sands, the facings on both bars had been identical but, due to the difficulty of preparation, the minimum amount of "close-packed" sand was used. If the frictional force between this sand and the metal is less than that between sand F13 and the metal, then, if two bars with different facings are cast side by side, any difference in contraction would give an indication of the relative value of the frictional forces.

Evidence of the relative effect of such frictional forces was shown by casting a series of straight and flanged bars using facings of "close-packed" and sand F13. The facing on the flanged bar always extended to a depth equal to the radius of the flange, while a 1-in. facing was used on the straight bar. Two straight bars with different facings were also cast, all the castings being made in grey iron at a constant pouring temperature.

If the restraint is considered to be made up of a frictional force and a force due to the resistance of the sand bulk, then the difference in total contraction gives a relative measure of each value. Let the force due to bulk sand resistance be represented by α_f and α_c (F13, and "close-packed" sand respectively) and that due to frictional resistance by β_f and β_c, then the differences in the forces operating in each bar may be taken as proportional to the difference in contraction. Thus the frictional restraint attributed to the floor-sand is large compared with that of the "close-packed" sand and also compared with the bulk resistance of either sand.

A similar series of tests was not carried out with the non-ferrous alloys. Their high coefficients of contraction coupled with their relative weakness at high temperatures may have accounted for the reversion to the normal state as cooling proceeded. The grey iron in "close-packed" sand possessed a substantial layer of burnt-on sand, the surface being so coarse as to suggest a fair amount of metal/sand penetration. The non-ferrous metals had a smaller amount of burnt-on sand adhering and this may have been instrumental in increasing the frictional force attributed to the "close-packed" sand. Whether or not the effective friction in the case of

TABLE VI.—*Frictional and Bulk-sand Restraint Due to "Close-packed" Sand.**

Facing sand.		Restraining forces.		Difference in contraction (in.).	Proportional to :—
Flanged bar.	Straight bar.	Flanged bar.	Straight bar.	Flanged bar—straight bar.	
CP.	F.13	$\alpha_c + \beta_c$	β_f	—0.017	$\alpha_c + \beta_c - \beta_f$
CP.	CP.	$\alpha_c^c + \beta_c^c$	β_f^c	+0.003	α_c^c
F.13	F.13	$\alpha_f^c + \beta_f^c$	β_c^c	+0.002	α_f^c
F.13	CP.	$\alpha_f^f + \beta_f^f$	β_c^f	+0.020	$\alpha_f^f + \beta_f - \beta_c$
F.13 (on straight bar)..	CP.	β_f^f	β_c^c	+0.019	$\beta_f^f - \beta_c^f$

* It will be seen from this Table that : α_c is proportional to 3 ; α_f is proportional to 2, and β_f is proportional to $\beta_c + 19$.

cast iron is between burnt-on sand and unaffected sand or between metal and sand does not affect the validity of the above argument.

A series of rectangular framework castings were made in grey iron having different facings around the centre and outer members. A facing of "close-packed" sand was placed around the outer members and N13 sand around the centre member and *vice versa*. Temperature measurements taken during the cooling of the "frameworks" showed that the temperature differences between the members were similar in each casting. The stress values quoted are the average for at least two pairs of castings; the values invariably agreed to within 0.3 tons per sq. in.

TABLE VII.—*Residual Tensile Stress in Centre Member of Rectangular Framework Casting using Different Facing Sands.*

Facing sand.		Stress (tons per sq. in.).
Centre member.	Outer member.	
F.13	F.13	4.7
CP.	CP.	3.1
F.13	CP.	5.1*
CP.	F.13	2.5

* In addition hot-tears occurred in two castings.

While a reduction in stress was obtained by the substitution of "closed-packed" for F13 sand around all three members, the use of "close-packed" around the outer members only accelerated still further their contraction relative to the centre member and resulted in a high residual stress or hot-tearing. Conversely the use of "close-packed" around only the centre member allowed the difference in contraction of the members to be reduced, resulting in a considerable decrease of stress.

These results, like those of the flanged bars, cannot be entirely attributed to compaction of the sand when subjected to the contraction of the casting. As the cooling rates were similar, the presence of different frictional forces between the sand and the metal alone would account for the stress reduction obtained with the above combinations of facing sands.

This appears to be one of the few instances where any frictional effect has been observed. Andrew and Protheroe[4] did not find any increased susceptibility to hot-tearing in a straight steel bar when using coarse or fine-grain sands and attributed this to the absence of any appreciable difference in the friction existing between the contracting metal and the sands. No attempt was made to determine the amount of contraction, however, and, therefore, the method was less likely to show the effects observed in the present work.

The present effect was encountered only in the "green" state and it is suggested that it may be due to the adhering sand forming a surface capable of easily sliding over the adjacent grains of unaffected sand. The sand was more plastic than any other used in the investigation and this plasticity may assist in causing the low frictional effect. As the sand possesses a property which appears to be unique, further experiments comparing the contractions of bars using both coarse and fine-grain facing sands would appear to be necessary before any definite conclusions can be drawn.

Acknowledgments

The Authors wish to record their indebtedness to Mr. M. G. Elston, of R. W. Hawthorn, Leslie & Company, Limited, Newcastle-upon-Tyne, and Mr. A. Braybrook, of Wm. Jessop & Sons Limited, Sheffield, for the supply of certain materials used in this work. The assistance of their colleagues, especially Mr. C. R. Tottle, in providing fruitful discussion and of Professor A. Preece for the provision of laboratory facilities, is also gratefully acknowledged.

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SIR EDWARD HERBERT, newly-elected president of the Cambridge University Engineers' Association, unveiled on July 11 a painting of the Duke of Edinburgh, who opened the new wing of Cambridge University Engineering Laboratory seven months ago. The artist is Mr. Terence Cuneo. Some 200 members of the Association, which had presented the painting to the Department of Engineering, met for the occasion. Prof. J. F. Baker, head of the Department of Engineering, accepted the painting on behalf of the Department.

AS A FURTHER STEP in their overseas development, Foundry Services, Limited, are now operating two further associate companies, making a total of five. Foundry Services (South Africa) Pty., Limited, has been formed in association with Victor Kent (Transvaal) Pty., Limited, and is under the managership of Mr. R. Cross, late of David Brown-Jackson, of Manchester; headquarters are in Johannesburg. In Italy, Societa Italiana Catalizzatori has been formed in association with A. Cesana, Soc.p.Az., with headquarters in Milan.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

To the Editor of the FOUNDRY TRADE JOURNAL

FLUIDITY TEST FOR QUALITY CONTROL

SIR,—In the letter appearing in the FOUNDRY TRADE JOURNAL on July 16, 1953, your correspondent overlooked the special features of the miniature spiral test. Unlike the Saeger & Krynitsky spiral mould, the miniature spiral mould is very easy to handle, and the test can be performed in a matter of seconds prior to the casting of a batch of moulds at the casting site. The test, therefore, gives not just *post mortem* evidence of misruns, but a diagnosis of the fitness of the liquid metal to yield a full casting.

It was pointed out in the original article that the miniature spiral moulds are easy and economical to make and the testing results are less dependent on pouring technique than those obtained from the Saeger & Krynitsky mould; moreover, the results can be quickly assessed. It would appear, therefore, that the direct measurement of the fluidity by this method is preferable to the indirect method of estimating the fluidity, namely, the measurement of temperature. This is particularly important in foundries where the composition of the liquid metal and the sand conditions either are not strictly controlled or are being changed from time to time; under such conditions, the fluidity value of a liquid metal cannot be determined merely by measuring the temperature.

Furthermore, it should be noted that the primary purpose of quality control is to prevent the occurrence of defects. Once the critical fluidity value of a specific casting is found, the determining of the fluidity of the liquid metal, particularly of suspected metal, by a simple test before casting a batch of moulds, can certainly help the foundryman to decide whether he should use, divert or reject the liquid metal.—Yours, etc.,

T. P. YAO,
Metallurgy Department.
The Royal School of Mines.
July 20, 1953.

Encouraging the Inventor

The chairman of a group of manufacturing companies has sent the Government a rather unusual memorandum. Pointing out that official figures show that the number of applications for Patents in this country is steadily declining (the annual rate has come down by some 6,000 since 1938), he declares that "hundreds of new ideas are lost because inventors, especially among the artisan class, are frustrated"—in the first place by the cost of taking out registrations, and in the next by red tape at the Patent Office.

So, "as there is no doubt that the inventive ability of our people is one of this country's greatest assets," he suggests this plan:—Make available at all Post Office forms of the value of, say, 5s., which, on being filled up and filed, would give applicants "preliminary protection" for their inventions. Next, each industry would be asked to form within its ranks a committee of three, with an independent chairman, which would examine ideas and notions that had been put forward. So, all persons with new ideas for particular industries would, no matter how small their means, be able to obtain prompt advice and assistance on questions of practicality, cost, commercial possibilities, the market outlook, and so on. Each committee would be in a position to recommend really good ideas to manufacturers within their field.

Poplar Technical College

Last Thursday, following the opening ceremony of an extension to the Poplar Technical College (formerly the School of Engineering and Navigation) by Mr. R. McKinnon Wood, our representative visited the new foundry department. It is conducted by Mr. F. G. Easter with Mr. J. P. Maher as a visiting lecturer—both associate members of the Institute of British Foundrymen. The practical department is housed in a light, airy room and is equipped with a crucible furnace well capable of melting iron; a Ballard core-drying stove ; and a power-driven sand riddle. There is an ample supply of steel moulding boxes and loose wooden patterns.

The College for many years has had a good reputation for teaching patternmaking and a well-equipped workshop has been provided. It is one of the few colleges which has organized a post-"City and Guilds" class for patternmakers who hold the final certificate or who have been journeymen for a minimum of 10 yrs., and are willing to take additional classes. Gearing, propeller work and foundry practice are included.

Both day and evening instruction are given in foundry practice and in patternmaking, where students in these subjects follow the City and Guilds of London Institute syllabus. At the moment there are about 20 day students attending one day a week from the local foundries. One of these firms, however, insists on the boys regularly attending evening classes for one year before they get the privilege of daytime release.

Scottish Fuel Efficiency

The Government's decision to transfer fuel efficiency services to a non-profit-making industrial organization directed by the British Productivity Council, as suggested in the Pilkington Report, has met with some opposition from the Scottish Fuel Efficiency Committee, whose chairman is Sir Patrick Dollan. When the Permanent Secretary to the Ministry of Fuel and Power, Sir John Maud, visited Glasgow recently, Sir Patrick made it clear that he would recommend his colleagues to carry through their winter programme of training in fuel efficiency and examination of plant where coal could be saved.

Sir Patrick has been chairman of the Scottish Fuel Efficiency Committee for 11 years. A member of the Clyde Navigation Trust, he is also a leading figure in Scottish aviation problems, being chairman of the Scottish Advisory Council for Civil Aviation as well as a director of British European Airways. He is a member of the Scottish Economic Conference and chairman of East Kilbride New Town Development Corporation. Sir Patrick was knighted in 1941.

Collaboration Acknowledged

Mr. Mirko Ros, doyen of the Swiss metallugical industry and late Professor of Metallurgy in the Federal Institute of Technology, has had struck in bronze a medal commemorating a quarter of a century of collaboration in the testing of materials—work in which he has been actively engaged throughout his professional life and in which few men have taken a greater interest.

The medal has been sent to a selected list of collaborators with Mr. Ros in all parts of the world. Mr. Alastair McLeod, metallurgical editor-in-chief of our sister Journal *Iron and Coal*, is one of the recipients.

Operating Experiences with Hot-blast Cupolas in Great Britain*

By F. C. Evans, F.I.M.

(*Continued from p.* 78)

THIRD PLANT

The third hot-blast plant to be described was put into operation during August, 1952. This was an adaptation of an existing pair of 4 ft. 6 in. dia., hand-charged cupolas operated by intermittent tapping and serving a centrifugal-casting foundry making piston-ring pots, cylinder liners, etc. The iron from the cupola is duplexed into electric furnaces, but any details quoted later for composition, tapping temperatures, etc., refer to the cupola iron. The iron produced from the cupola varies in desired composition from day to day but is all normally of the T.C. 3.2, Si 2.3, P 0.5 and Mn 0.9 per cent. type.

This hot-blast plant is also a recuperative one but has a Schack spiral/radiation recuperator instead of the tubular/convection recuperator described in the second plant. The layout is shown in Fig. 6 and here again it must be emphasized that the layout is not an ideal one, but the best that could be arranged to fit the site.

As in the previous recuperative plant described, the gases are withdrawn from the cupola through a special neck† built-in below the charging door. When the dust-laden gases leave the cupola they pass directly to a dust trap, after which is placed the isolating valve for sealing off whichever cupola is not in use. The gases passing through the insulated top-gas main pick up combustion air through a special burner, just at the point of entrance to the firebox. Combustion is maintained in the firebox by a pilot gas-burner. The recuperator, which sits on top of the firebox, consists of two large-diameter concentric tubes with a narrow annular space between. The blast passes through this annular space, guided in a contra-flow manner from top to bottom by a spiral baffle. The burnt gases pass through the central space and heat up the blast mainly by radiation, the inlet temperature being about 1,000 deg. C. Waste gas passes to atmosphere through a chimney which provides the necessary suction through the system leading back to the cupolas. The heated blast passes through an insulated main to the insulated wind-belts. Expansion joints, etc., are provided at suitable points to take up the expansion and contraction during heating and cooling.

Design Features

As can be seen, this spiral/radiation recuperator presents only one large surface for heat transfer, in contrast to the large number of tubes in the tubular/convection type. This minimizes cleaning and, in addition, this radiation recuperator is not so sensitive to dust deposits and high efficiencies are still maintained despite a dust layer. This plant is capable of producing from 5 to 6 tons per hr. of iron and the recuperator can deliver 2,100 cub. ft. per min. of air heated to 500 deg. C. This is the top limit for this type of recuperator, while the tubular/convection recuperator described in the last plant can be made in any size.

From Fig. 6, it will be seen that the internal diameter of the cupolas was reduced to 2 ft. 6 in. dia. at the tuyere level but increased to 3 ft. 3 in. dia. at the charging point. This has no special significance, but was the simplest solution, for making the throat of the take-off too small leads to bridging of the charge. Apart from this alteration to the lining and the provision of the gas take-offs, no alteration to the cupolas was made, except to increase each of the four tuyeres to 6 in. by 10 in., giving a total tuyere area of 240 sq. in., or a ratio to the cross-sectional area of the cupola of 1 : 3. The wind-belt was left as it was, except for covering it with slag-wool insulation. Fig. 7 shows a view of the plant taken from the stockyard and shows a few additional points not shown in Fig. 6. The dust legs in the bottom of the top gas valve can be seen and an instrument panel is positioned so that the cupola operator can adjust the blast volume with the wind-belt valve, while observing the effect on the blast-volume meter.

At present, this cupola plant produces between 20 and 30 tons per day in 8 to 9 hrs. at an average rate of 3 to 3½ tons per hr., although the cupola dimensions are capable of giving 5 to 6 tons per hr. The normal blast volume used is 1,500 cub. ft. per min. It should be noted that the cupola is being run well below its rated capacity and in particular the cupola diameter is too large for the output per hour produced.

Charge Particulars

The cupola charge weighs 800 lb. With cold blast it was normally made up of about 50 per cent. pig-iron, 40 per cent. of solid foundry returns and 10 per cent. of briquetted swarf. In common with many foundries, the iron charge is weighed but the coke is not and is added by a volume method. However, the coke consumption on cold-blast working has been arrived at by calculation from stock figures as 14.5 per cent. for the charge coke (neglecting the bed). The grade of coke used (and still adopted for hot-blast working) is Welsh Navigation Coke, of the same composition as mentioned

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* Paper presented to the London branch of the Institute of British Foundrymen, Mr. D. Graham Bisset presiding. The Author is a director of Metallurgical Engineers, Limited, London.

† British Patent No. 662325.

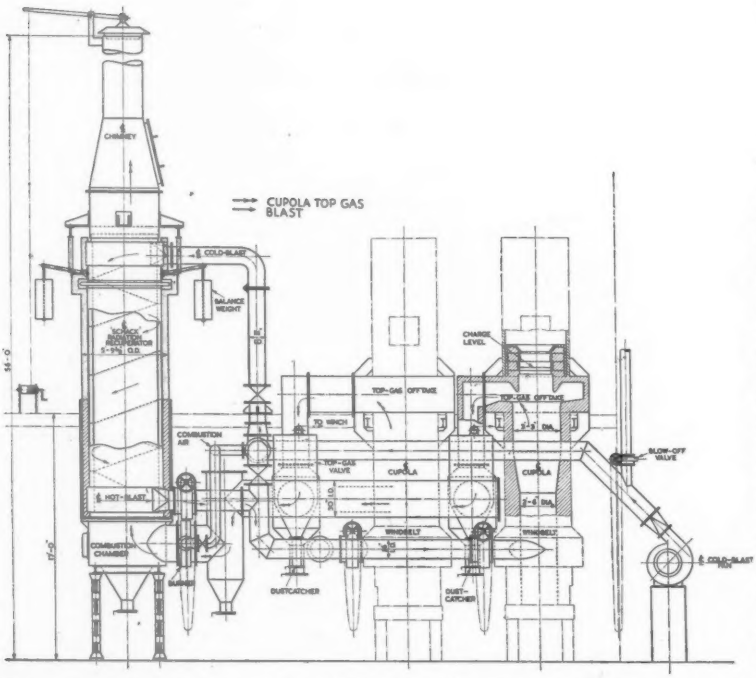

FIG. 6. — *Layout of the Third Hot-blast Plant described. This incorporates a "Schack" Spiral/Radiation Recuperator delivering* 2,100 *cub. ft. per min. at* 500 *deg. C.*

earlier. On turning over to hot blast, the coke has been reduced but as the coke is not weighed no exact figure can be given until a longer period has elapsed and a new calculation can be made from stock figures. From spot checks made, however, it would seem that the charge coke now is about 11 per cent., representing a saving of 25 per cent.

While there has been a change in the composition of the charge, which is described later, this is not a striking one for the following reason. To minimize silicon and manganese losses, or to carburize steel scrap to the maximum, it is necessary to maintain the blast temperature in the region of 500 deg. C. In this particular foundry, this is not always possible because the cupolas are not blown continually throughout the day, mostly due to lack of holding capacity in the duplexing furnaces. The effect of non-continuous blowing and details of the start-up are shown in Fig. 8.

It will be seen that, although the blast temperature rapidly reached a temperature of 500 deg. C. in about ½ hr. from the start of blowing in the morning (the chart starts on the right-hand side), this temperature soon dropped after about one hour. This is because blowing ceased on the occasion recorded and, indeed, only continued in short bursts throughout the morning until just before luncheon at 12.30 p.m. when there was about 1-hr's steady blow and the blast temperature again mounted to 400 to 500 deg. C. On the resumption of blowing after luncheon (about 1.45 p.m.), blowing was fairly steady throughout the afternoon until 5 p.m., when blowing ceased. During this time, the blast temperature remained fairly steady at about 450 deg. C., the slight fluctuations being due to tapping, slagging, etc., when the blast was taken off or reduced. Proposals have been made to overcome this fluctuating blast-temperature by additions of coal gas which would be automatically added to the firebox when the blast temperature dropped below a certain temperature. The founders, however, feel that it would be better first to try blowing continually and this will be done as soon as arrangements have been completed to increase the capacity of the holding furnaces.

As it is impossible to count on having the blast at about 500 deg. C. throughout the day, the founders are unable to feed the cupola with charges containing high scrap percentages, as the metal tapped after a shut-down (and produced by only moderately-hot blast) would be outside the tight analysis limits to which they have to work. However, in spite of these fluctuating blast temperatures, they have found it possible to charge 7½ per cent. steel regularly, whereas with cold blast 2½ per cent. was the maximum, any higher percentage giving hard spots on the castings. If no steel is charged and they use the old cold-blast charge, the carbon content is increased by 0.10 to 0.15 per cent., whereas if 10 per cent. steel is charged the carbon content remains at the calculated figure. In practice, therefore, they prefer to charge 7½ per cent. steel and gain a few points of carbon which they find beneficial in many ways. No appreciable effect on silicon and manganese contents has been noted, as could be expected from Continental experience, which has shown that, up to 300 to 350 deg. C. blast temperature, there is little effect on the manganese and silicon losses.

Other Benefits

Sulphur, however, has decreased considerably and, in 5 months running, the average sulphur

content has fallen from 0.13 to between 0.10 and 0.11 per cent. The percentage of returned scrap charged is 40 per cent. and as it takes a considerable period for scrap to be returned from the machine-shops, it is felt that eventually the sulphur content will drop still lower.

Tapping temperatures vary, of course, with the hot-blast temperature. When there has been a run with blast at 500 deg. C., tapping temperatures of about 1,450 deg. C. are achieved which are about 40 to 50 deg. C. hotter than with cold blast. These temperatures are estimated only, as no pyrometric equipment is at present available, but higher temperatures are definitely indicated, as more efficient desulphurization is taking place in the ladles with the same quantity of soda ash.

The most noticeable benefit of hot blast in this foundry, however, has been the effect on scrap. It is, of course, always difficult to attribute scrap to any one cause, or *vice versa*, attribute better castings to improved practice. This foundry, however, only produces centrifugal castings and records are most carefully kept. Since last August, the date of the starting-up of the plant, scrap figures have shown a consistently downward trend and are still continuing in a downward direction. The lower sulphur and higher carbon contents are no doubt contributing to this, but foremen and casters say that the metal is " cleaner."

Effect on Working

The working of the cupola is now considerably easier and, whereas, with cold blast, blocked tuyeres and " barring" were a regular occurrence, as might be expected from the frequent stops in blowing, this is now totally eliminated. Conditions at the charging hole are much cooler and cleaner and the apparatus is extremely popular with all the cupola operators. Patching of the cupola, which is brick-lined, has proved to hold no difficulty, the quantity of ganister used being slightly smaller than with cold blast. No special patching is used, although it was anticipated that this might be necessary.

As previously explained, the spiral/radiation recuperator is designed to minimize cleaning. This particular plant, however, has proved to exceed the most sanguine expectations as, on installation, it was stated that a fortnightly cleaning would be needed. In fact, this plant, which has been working now for six months, has not yet needed any cleaning beyond the emptying of the dust legs at the bottom of the dust traps and firebox and a rake out weekly of the top-gas take-off on the cupola. It is interesting to note, however, that there is a difference in the dust obtained on this plant, using Welsh Navigation Coke, and that obtained from the plant using short-cycle blast-furnace coke, although the ash contents shown by analysis are not widely divergent. The dust from the blast-furnace coke is very light and flocculent, while the dust from the Welsh Navigation Coke is heavier and deposits in a denser layer.

Dust Emission Suppressed

A most interesting feature, however, is that the plant, cupolas and hot-blast system as a whole, have virtually stopped emitting dust. At the same time as the hot-blast system was installed, the

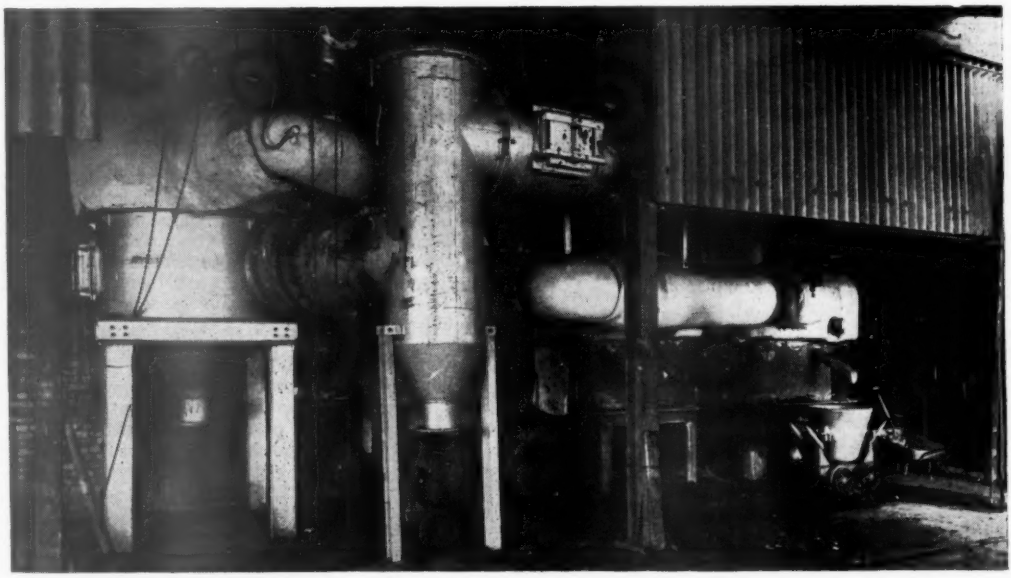

FIG. 7.—*View of the Third Hot-blast Cupola described. Adjacent to the Furnaces is an Instrument Panel, housed behind a Glass Window.*

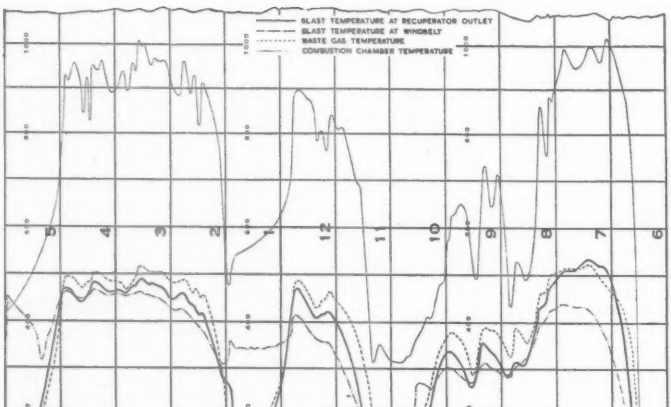

FIG. 8.—*Temperature Chart from the Third Hot-blast Plant described, which employs a "Schack" Radiator Recuperator. The Record reveals the Effect of Discontinuous Operation.*

foundry roof-lights were cleaned. These roof-lights, adjacent to the cupolas, are now (February) as clean as they were last August, while previously they would have been covered with dust and impenetrable to light with two to three days. An inspection of the roof and gutters also shows no deposit whatsoever. When the plant is working there is some white smoke from the cupolas and a plume of white smoke from the recuperator stack, but neither seems to contain solids and they disperse within a few yards of the foundry. The weekly weight of dust taken from the plant is between 600 and 900 lb., or between 6½ and 9½ lb. per ton of iron produced. Almost all of this dust, however, is trapped in the first dust traps near the cupola, obviously because of its much higher density than the dust from the tubular plant, of which a high proportion reaches the tubes and firebox.

An inference might be drawn, therefore, that Welsh Navigation Coke produces a heavier weight of dust in the cupola top gas, but due to its greater density this is more easily trapped. Blast-furnace coke, on the other hand, probably gives less dust in the top gas but this is more difficult to deal with due to its flocculent and light nature.

Conclusion

This then is the position with hot-blast cupolas in Great Britain to date and there remain many gaps to be filled in. There is sufficient information, however, to show that the trend of British results is exactly the same as those obtained on the Continent and elsewhere. A very strong case can be made out for the hot-blast cupola in Britain for a number of applications, although it is evident that hot blast will not be always advantageous, either technically or economically. In the first place the cupolas should run continuously, preferably with continuous tapping so as to obtain steady blast temperatures. Secondly, from the economic viewpoint, the cupolas should run for more than 4 or 5 hrs. per day. Thirdly, they are of the most advantage where a high-quality "hot" iron is required. Given these broad conditions, a good case for hot-blast can be made out, although other sets of conditions are not totally excluded.

It should be emphasized that this is the position to-day. With little likelihood of coke and iron supplies improving—either in quality or price—the case for hot-blast can only get stronger. Recent developments, too, in other fields, may make hot-blast for cupolas even more attractive. Industrial gas-turbines are already developed which, if coupled to a 12 to 15 tons per hr. cupola using 10 per cent. charge coke, are capable of driving, by means of the cupola top-gas alone, a 750 kw. generator and, at the same time, pass out blast to the cupola at about 500 deg. C. This will give some measure of the economy that is possible and the fuel which is at present being wasted.

DISCUSSION

MR. DRISCOLL, opening the discussion, complimented the Author on his survey of the effects of hot blast on cupola operation. Mr. Evans had explained that he was only able to comment from personal knowledge of three of the hot-blast plants which were working in this country and he was unable to submit details of the fourth operating plant or of a further one* which was under construction.

The speaker was, however, able to give some information relating to the plant which was, in fact, the first modern recuperative hot-blast cupola installation in this country and which had now been working for nearly two years. It was, admittedly, a plant where the maximum benefits from hot blast could probably not be expected, due to the particular working conditions and the type of castings being produced. However, the installation had been justified by the results which had been obtained.

When the plant was first put into operation, the main difficulty which was met was that the metal was too hot for the particular conditions in this foundry. Even with hot blast there is a lower limit of coke consumption below which it is not practicable to go for lengthy periods; this corresponding to about 7 per cent. or a ratio of about 15 : 1. The solution arrived at in this foundry, to avoid excessively high metal temperatures, was to use approximately this minimum coke consumption by

*See page 119 of this issue—EDITOR.

weight, a large proportion of which was a relatively inferior grade of coke.

On the question of carbon pick-up, it was found that for a given metal charge, the carbon pick-up was about 0.1 per cent. higher than with cold blast. This increase would doubtless be higher if it were possible on the plant in question to take advantage of the available higher melting temperatures.

Mr. Evans had referred to the question of dust deposition and the need for a recuperator which did not readily accumulate dust or, if it did, which could easily be cleaned. He had indicated that, with modern designs, users need not be unduly worried about this aspect. It was of interest to record that, in the plant referred to by the present speaker, the labour involved in cleaning the recuperator and the rest of the installation was 10 man/hours per week. The weekly production of molten metal in the hot-blast cupolas was about 1,600 tons, over a total melting period of 80 hours.

Use of Inferior Coke

MR. HARDING thought the most interesting point in regard to the hot blast was the possibility of using inferior coke, because there was a downward trend in the quality of coke which was likely to continue. If the use of blast-furnace coke was likely to become general, it would be an interesting point.

The other point he would like to raise concerned the blast velocity. Due to the hot blast, the volume of a given quantity of oxygen, or air, at a temperature of 500 deg. C. must be quite considerable, so the blast velocity should be very much higher than it would be at ordinary temperatures. What effect did that have on actual conditions?

MR. EVANS said he hoped he had been clear about the use of blast-furnace coke. The second plant described, using a hot-blast system, was previously using blast-furnace coke—with cold blast it was standard practice there—and they seemed to produce a good grade of iron. He would make no further comment on that except that it did show that a hot-blast plant could be worked just as readily with blast-furnace coke as with any type of foundry coke.

With regard to the velocity of the blast in the blast main, unless the diameter was increased, which it normally was, the velocity was naturally higher at 500 deg. C. It would be from two to three times higher than the same volume when cold and, also, in the tuyeres unless the size of them was increased. But once it got inside the cupola, presumably, the air whether cold or hot, quickly reached the same temperature, the temperature of the melting zone, so the speed of the gases passing up the stack was obviously no different whether hot or cold blast was used.

MR. PARKES asked if Mr. Evans could say if raising the blast inlet temperature and so rapidly attaining combustion temperature inside the cupola, led to a short melting zone in the shaft.

MR. EVANS said that the melting zone in a hot-blast cupola was considerably shallower than in a cold-blast cupola. That was put down to the fact that as the air was already heated the oxygen combined much more readily with the coke and therefore made the melting zone much hotter—it was said, about 200 deg. C. hotter—and also it made it shorter.

Vote of Thanks

MR. WILSON said the last time he had risen to propose a vote of thanks in that room was on the occasion of Mr. Renshaw's paper on cupolas. That paper and the present one had one thing in common, they had shown a great deal of work was being done in the foundry industry which proved that the industry was alive and searching for new ideas and means of making metal hotter and cheaper. Members were indebted to Mr. Evans for putting so many facts before them. Discussion had not been too lively, but he thought that this was due to their having been given a lot of facts which called for considerable thought. He had much pleasure in proposing a very hearty vote of thanks.

Mr. Colledge, seconding the vote of thanks, said all present knew a little about hot blast initially, but he thought they would go away from that lecture with a better knowledge of the desirable temperature of the blast and the methods of attaining it, and securing the advantages which it gave. The lecture had been excellently presented and he felt sure members would seriously have to consider the pros and cons of hot-blast melting.

The vote was carried with a hearty round of applause.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference E.P.D. or C.R.E. can be obtained from the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, London, S.W.1.

STOKE-ON-TRENT, July 30—Supply of cast-iron work and cast-iron pipes and specials for the six months ending March 31, for the City Council. The City Surveyor, Town Hall, Stoke-on-Trent.

INDIA, July 31—Air compressors, for the Director General of Supplies and Disposals, Government of India. CHAncery 4411 (CRE/23420/53).

SOUTH AFRICA, August 13—Portable air compressor, for the South African Railways. Room 7154 (CRE/23482/53).

SOUTH AFRICA, August 6—Portable air compressors, for the Stores Department of the South African Railways. Room 7154 (CRE/22720/53).

TWENTY-FIVE STUDENTS selected from Canadian universities have been offered technical and professional training in the English and Canadian factories of the English Electric Company, Limited.

A NEW ELECTRIC FURNACE, with a capacity of 2 tons 15 cwt., which was installed by Birlec, Limited, Birmingham, was tapped last week at the works of Osborn Foundry & Engineering Company, Limited, Sheffield. It is expected to increase steel output by 150 tons a week.

DENVER EQUIPMENT COMPANY, LIMITED, Salisbury House, London Wall, London, E.C.2, in collaboration with its South African associates, announces that it can now supply S.R.L. (soft-rubber lined) centrifugal sand pumps, which can be ordered from the company and paid for in sterling currency.

Employees' Shareholding

One-fifth of the Willenhall (Staffordshire) factory of John Harper & Company, Limited., is owned by 300 of the firm's 1,100 employees, it was revealed recently. Next month they will draw £10,000 out of the profits of the firm which—despite a fall in trade and earnings—is still able to maintain a 30 per cent. dividend for shareholding employees and ordinary directors.

What is the secret of the firm's success? At a recent meeting, Mr. Harper, chairman of the company and a founder of its co-ownership scheme, explained that the employee shareholders were a great steadying asset in the factory. In effect, he was turning all the employees into capitalists, but there was nothing political behind it. The idea was to give the men a sense of responsibility and it certainly succeeded. The standard of workmanship in the factory was exceedingly high and there was very little waste of material. Once a year, an informal meeting of workers was held in the evening and he reminded them that the plant and buildings were their own property—and so they looked after them. "As a result, the staff worked together as a unit and the firm have never had any strikes. At the informal meetings which," he said, "were attended by directors, the production engineer and other executives, all difficulties were explained and discussed and the future prospects were outlined so that all the workers should be in the picture." Of the company's capital, £50,000 has been subscribed by the workers—and there was a long waiting list of employees who wanted to buy shares which were split into units of 25 so that more employees could join the scheme. If a man left the firm, he had to sell his share, which was then reallocated by a committee of the workers. The firm's ordinary 5s. shares were worth about 19s. 6d. and workers could buy £1 shares at par value. Some of the workers hold the maximum of 500 shares each. The firm made a profit in 1952 of £145,960 compared with £195,900 the previous year.

Changed Name and Address Only

The "industries branch" of the Board of Trade's Commercial Relations and Exports Department moved to Lacon House, Theobalds Road, London, W.C.1, on July 21. The new telephone number is CHAncery 4411. At the same time, its title is changed to "export services branch." This title better describes the functions of the section, which are unchanged, namely, to help U.K. manufacturers to find representatives or agents abroad; to assist U.K. businessmen going abroad; to provide information about overseas markets and to advise industrial organizations and individual firms on the opportunities and methods of exporting their goods; to provide information about tariff and import licensing regulations abroad; and to distribute information of use to exporters through the "Special Register" information service.

Inquiries relating to trade policy between the U.K. and individual countries overseas and to general policy not peculiar to trade with any one country, *e.g.*, the General Agreement on Tariffs and Trade (G.A.T.T.), commercial treaties, and relations with O.E.E.C. (the Organization for European Economic Co-operation) should continue to be directed to the Commercial Relations and Exports Department, Horse Guards Avenue, Whitehall, London, S.W.1 (TRAfalgar 8855).

THERE HAS BEEN such a glut of ore carriers arriving in the Tees during recent weeks, that ships have been kept waiting for berths.

Book Reviews

Les Fontes Spéciales-leur elaboration; leurs emplois. (Special-duty Cast Irons; Manufacture and Use) by O. Bader and D. Godot. Published by Editions Eyrolles, 61, Boulevarde Saint-Germain, Paris V. Price 1,820 French francs.

One of the objects of this book, written by two of the staff of the Fonderies Theret of Neufmanil in the French Ardennes, is to dispel the currently-held notion that cast iron is a single alloy and to replace this idea by the truer conception that cast iron embraces a very wide series of alloys capable of fulfilling many diverse applications. At the same time, the Authors have tried to tell the foundryman more about the science of his job. Actually, this takes up nine-tenths of the space and the propaganda part will still have to be the work of the foundry sales staff, as but few users of cast iron are sufficiently energetic to ferret out technical data for themselves. The reviewer approves of the printing of a general bibliography at the end instead of making hundreds of references to the works of others, because, obviously, writers of text books of wide coverage *must* draw upon the publications of others. What would improve the book, however, is the provision of an index, a contents list is usually inadequate when seeking information on any specific point.

"Alloyed Cast Irons," covered in the second part of the book, embrace the use of nickel, chromium, molybdenum, high-silicon, aluminium, speroidal-graphitic and malleable types. Heat-treatment and rapid control tests are featured in the third section, whilst in the fourth the various melting furnaces used in ironfoundry practice are shortly reviewed. The penultimate section deals with foundry metallurgical defects, whilst the closing one is the classification of cast irons from the aspect of their ultimate use. The parts which most appeal to the reviewer are the sections dealing with malleable and this one on classification. The chapter on electric melting is not quite in accord with the conditions in this country.

V.C.F.

Fifty Years of Flight. A chronicle of the Aviation Industry in America, 1903 to 1953, by Welman A. Schrader. Published by the Eaton Manufacturing Company, Cleveland, Ohio. Price $5.00.

This is certainly a beautifully-produced book, and is of distinct interest in as much as it is brought out by a foundry concern working *inter alia* for the aeronautical industry. From a European point of view, however, it loses much, as only American achievements are chronicled. It is reasonably certain that if this book were amended to make it international, it would make it of the same interest globally as it no doubt is to American readers.

Jordans Income-tax Guide, 1953-54. By Charles W. Chivers. 23rd edition. Price 2s. net.

Completely revised in accordance with the new rates and allowances, this booklet explains in clear and simple language many problems of the taxpayer. The secretaries of foundry concerns will find this small booklet most useful. The basis of income-tax assessment is given in detail, and rates and allowances for 1953-54 are conveniently summarized. Facts about such matters as returns, assessments and appeals are supplemented by worked examples under P.A.Y.E. and rates of income tax and sur-tax over a wide range of earnings.

IT IS REPORTED that Yugoslavia has restricted, among other commodities, the import of pig-iron and rails.

Another Hot-blast Cupola Plant

Installation at Dartmouth Auto Castings Limited

Although scores of hot-blast cupola installations are working or under construction on the Continent and in the U.S.A., the number of such plants in the U.K., may still be counted on the fingers of one hand, so that the starting of a new installation here is still an interesting event. Three British installations have already been described in these pages and a fourth is detailed below.

Early in 1952, Mr. W. Brindley, works director of Dartmouth Auto Castings, Limited, accompanied by Mr. C. W. Moss, chief metallurgist, visited Germany to see representative examples of the latest hot-blast cupolas working in that country, where equipment manufacturers appeared to have arrived at designs in advance of those available elsewhere. Dartmouth Auto Castings already had experience in the manufacture and erection of much of the equipment installed in their own fully-mechanized foundries, and in April, 1952, it was decided to commission Cupodel, Limited, of London and Birmingham, with the design of new equipment for the conversion to hot blast of a pair of cupolas in one of the company's foundries together with the supply of the actual recuperator and full instrumentation. Cupodel, Limited, is a newly-formed company having, nevertheless, a wide experience of hot-blast techniques, and specializing in the design and supply of hot-blast equipment or of complete melting units incorporating hot blast. In this particular installation, the recuperator itself was to be manufactured by L. & C. Steinmüller, G.m.b.H., of Gummersbach, Germany, a model of this design having been in operation at the Stanton Ironworks Company, Limited, for some time previously. The rest of the construction and installation was undertaken by Dartmouth Auto Castings, Limited, themselves.

Requirements

In the foundry concerned, there were four cupolas each with a nominal melting capacity (on cold blast) of 8 tons per hr. The metal requirements were then about 12 tons per hr., so that it was necessary to operate two cupolas during each

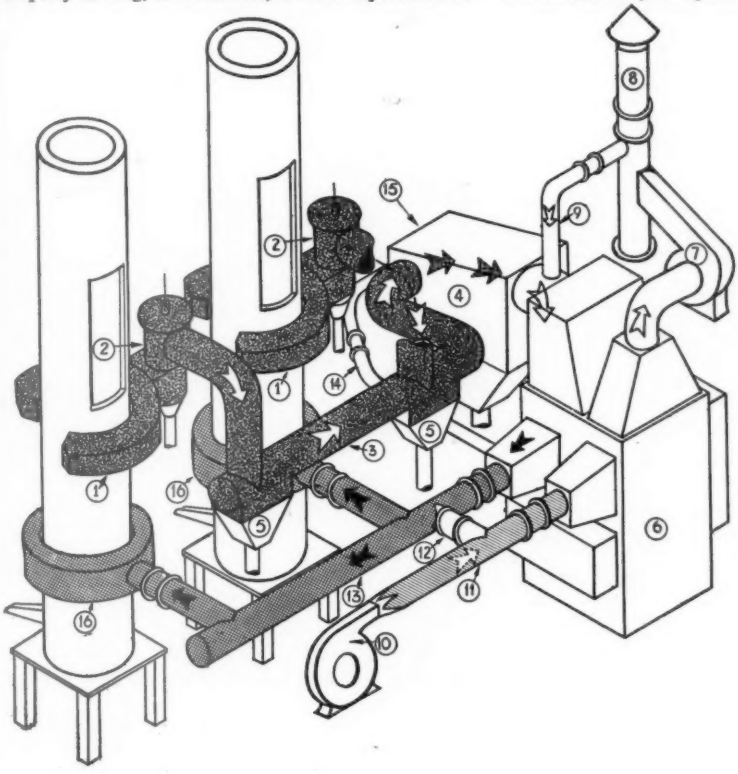

FIG. 1.—*Schematic Diagram of the Installation of Hot Blast to Cupolas at Dartmouth Auto Castings, Limited. The Take-off Gas System leading to the Combustion Chamber is shown dotted; the Cold-blast Portion of the System leading to the Recuperator is shaded, and the Hot-blast Portion, leading from the Recuperator to the Cupola Wind Belts is cross hatched.*

Key.—(1) Stack-gas offtake belts; (2) stack-gas dampers; (3) stack-gas main; (4) combustion chamber; (5) dust hoppers; (6) recuperator; (7) exhaust fan; (8) exhaust stack; (9) waste-gas recirculation; (10) cold-blast fan; (11) cold-blast main; (12) recuperator by-pass; (13) hot-blast main; (14) hot secondary-air main; (15) cold secondary-air valves, and (16) wind belts.

FIG. 2.—*View of the Combustion Chamber, where the Cupola Take-off Gas is Burned with the admittance of Secondary Air, the products of Combustion passing to the Recuperator.*

working day. It was established that, with hot blast, the output of one cupola could be at least 12 tons per hr. and one of the factors leading to the decision to order hot-blast equipment was, therefore, the anticipated saving in labour charges for running one cupola instead of two. In addition to this, it was, of course, expected that savings would result from the reduced consumption of coke, ferro-silicon, pig-iron, etc.

The hot-blast equipment was in fact ordered and designed for a capacity of 15 tons per hr. from one cupola, and while, at the time of writing, the requirements of the foundry have not exceeded 10 or 11 tons per hr., the indications are that the higher melting rate could readily be obtained. Situated at the end of the row of four production cold-blast cupolas was a further small cupola which was seldom used, and the removal of this furnace provided ample room for the installation of the hot-blast equipment to serve alternately the two cupolas nearest to it.

Constructional Details

The general arrangement of the two cupolas and the hot-blast equipment is shown diagrammatically in Fig. 1. The gases used for heating the blast, which are withdrawn through three ports a short distance below the charging door of the cupola in use, are collected in an offtake belt and passed through a damper into the stack-gas main, dust hoppers being provided in the stack-gas dampers and at the points of entry into the main. The gas damper for the cupola not then in operation is kept closed, of course, so that air is not drawn into the stack-gas main where it might cause premature combustion.

Burning of the extracted gas takes place in the combustion chamber (Fig. 2), either hot or cold air supplies being available for its combustion. The combustion chamber itself is of special design and has adequate capacity to give good mixing of the gas and air and to ensure complete combustion of the stack gas which, compared with other gaseous fuels, is low in calorific value and does not burn steadily if conditions are unsuitable. The combustion chamber is fitted with two small oil burners which are used at the beginning of the day to preheat the brickwork and maintain combustion of the gases in the early stages of the melt, but as soon as the cupola gases are burning steadily then these burners are shut off. One is re-lit during the lunch-time break to maintain the combustion chamber temperature.

Recuperator

From the combustion chamber, the hot gases pass to the recuperator unit where they pass around the outside of four banks of tubes through which incoming blast air for blowing the furnace is passed. As is normal with recuperators, heat-transfer takes place through the walls of the tubes. In this case, sensible heat on the outside contained in the hot gases resulting from combustion of the cupola take-off gas is picked up by the blast intended for blowing the cupola, which enters the tubes at ambient temperature and rises to about 500 deg. C. on leaving. The tubes are of rectangular shape, arranged with the major dimension vertical, and suitably spaced. High rigidity at elevated temperatures, large surface area for heat transfer and negligible horizontal surface upon which dust

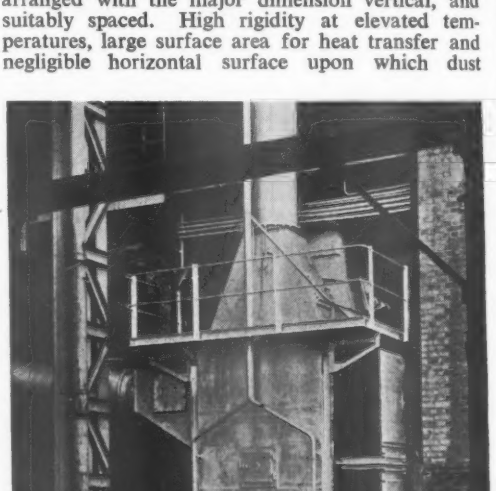

FIG. 3.—*Recuperator Unit, in which the Heating Gases pass around a series of Rectangular-section Tubes carrying, internally, the Cupola Blast to be heated.*

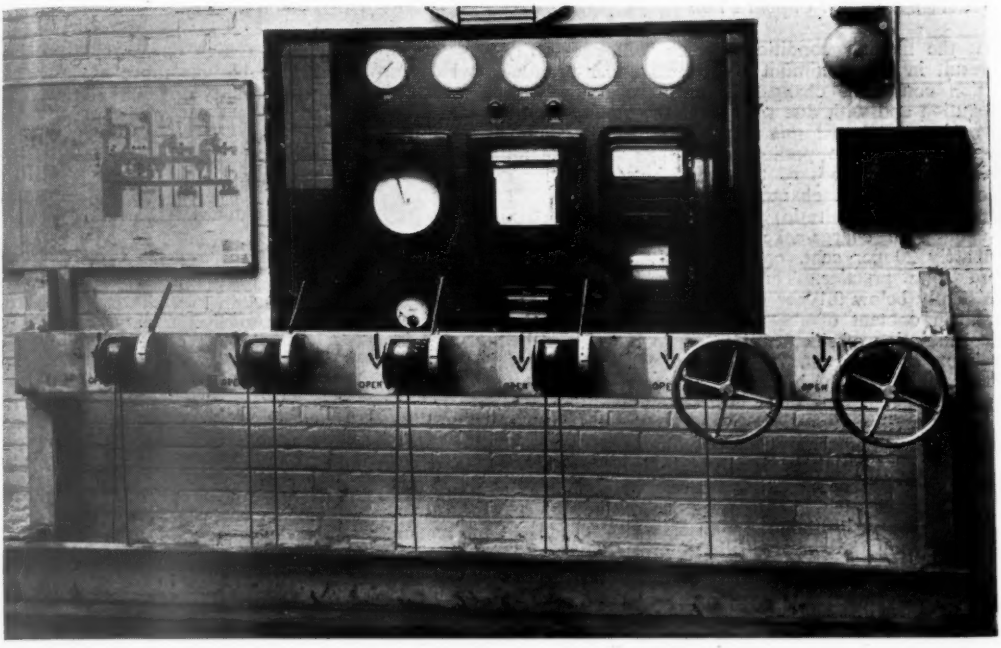

FIG. 4.—*Instrument Panel, housed behind a Partition Wall and Glass Window, with the Various Damper Control Winches in Front.*

accumulations can build up are thus conferred. A view of the outside of the completed recuperator is shown in Fig. 3.

The temperature of the gases entering the recuperator is kept as low as is consistent with obtaining the desired blast temperature. This gas temperature is conveniently and effectively controlled by diluting the hot gases from the combustion chamber with a certain amount of cool waste gas leaving the exhaust fan. On leaving the recuperator, the spent gases which have now lost much of their heat pass through an exhausting fan and so to the recirculation main and eventually to the stack. The exhaust fan is of special design to deal with hot gases, having a paddle-wheel type of impeller and water-cooled bearings.

The cupola blast supplied by a Keith Blackman high efficiency fan, is heated in the recuperator tube banks and thence passes *via* a hot-blast main and valves to the wind belts of the cupolas—insulated with glass wool. Air is controlled by a remotely-operated butterfly valve between the fan and the recuperator, the isolating valves in the hot-blast main for shutting off one or other of the cupolas being supplied by Westwood & Wrights, Limited, and of a special design suitable for the blast temperatures reached. The whole system is controlled centrally at an instrument panel, supplied by Elliott Brothers (London), Limited, and illustrated in Fig. 4. It contains air-flow and pressure recorders, a six-point electronic temperature recorder, a temperature regulator and gauges indicating the pressure at various points in the gas system. Fig. 4 also shows, in the foreground, the manually-operated winch controls for the various dampers and valves.

Operating Experience

The plant was commissioned in the middle of April, 1953, and since then has been solely relied upon for supplying 90 to 100 tons of molten metal per day for production purposes and has worked with remarkably little operating trouble in spite of the apparent complexity. The cupolas were relined to an internal diameter of 46 in., and no difficulty is experienced in obtaining a melting rate of 10 to 11 tons per hr. under these conditions, which with cold blast would be expected to give 7 to 8 tons per hr. The plant was designed for an output of 15 tons per hr with a blast temperature of 450 deg. C., but it is found easily possible to obtain blast at 500 deg. C., largely due, no doubt, to the fact that the plant is working below full capacity. The blast temperature has, therefore, generally been maintained at about 500 deg. C. as it is well within the capacity of the recuperator and is obtainable with a comparatively low heating gas temperature and hence a low operating temperature for the tubes—a factor which is expected materially to increase their "life."

In the relatively few weeks that the plant has been operating, it has not been possible to arrive

Another Hot-blast Cupola Plant

at the melting conditions which will necessarily result in the maximum savings, as under production conditions changes have to be made with caution and with due regard for the quality of the molten metal. At this stage, therefore, it is only possible to give preliminary results and general trends. For much of the time, the cupolas have operated with a charge coke consumption of 9.2 per cent (10.9:1 ratio) this corresponding to a reduction in charge-coke consumption of approximately 20 per cent. compared with the previous cold-blast practice. The silicon loss has been consistently below 0.1 per cent. or 4 per cent. of the silicon content of the charge. This enabled the consumption of silicon briquettes to be reduced by about 70 per cent. of the previous (cold blast) amount. With the higher cupola temperatures, the slag fluidity is such that the limestone addition can be reduced by about 60 per cent. without entailing difficulty in slag removal. The volume of slag produced and the labour involved in handling it is, of course, reduced in consequence.

After each melt, the eroded zone of the cupola lining is much shallower than with cold-blast practice and the radial depth of erosion has also been found to be much less than was expected, this not exceeding about four inches at the end of the day's melt. The eroded zone is repaired daily with fire-brick and ganister, and the refractories used for repair purposes are less in total than were used with cold blast. The tuyeres remain virtually free from frozen slag throughout the melt, and variations in air supply and melting conditions arising from this source in cold-blast practice do not therefore occur.

Metal Quality and Control

It is not the normal practice in this foundry to measure metal temperatures but there is no doubt that these are higher and more consistent than those obtained from the cold-blast cupolas. The metal quality as a whole, shown by the finished castings, has been perfectly satisfactory and there is a very firm impression that the metal is much less prone to chill with occasionally low carbon or silicon contents than is cold-blast metal. At the conclusion of the luncheon break, when melting has been interrupted for a period, the temperature recovery on restarting is very rapid and very little metal is pigged. After the first week or two of operation, the method of control was fully understood by the cupola operators and no extra staff has been found necessary for the operation of the plant which is now carried out by the melting shop foreman along with his other duties. During each day's operation, a layer of fine dust builds up on the surfaces of the recuperator tubes but not to such an extent that the blast temperature is affected. This layer of dust is, however, removed each morning by means of a percussion air lance, this operation occupying one man for about 20 min.

To summarize, the foundry staff feels that the hot-blast cupola plant is one which is capable of providing molten metal of very satisfactory quality, with appreciable savings in the cost of charge materials; that it has a high degree of flexibility which provides a valuable insurance against possible variations in the quality of raw materials, and that a contribution towards better community relationships has been made by the very appreciable reduction in the emission of objectionable dust and grit into the atmosphere.

Butterley Company's Capital Reduction

A reduction of the capital of Butterley Company, Limited, Ripley (Derbyshire), from £2,500,000, to £1,600,000 by returning to the ordinary shareholders capital in excess of the wants of the company was confirmed by Mr. Justice Vaisey in the Chancery Division last week.

Mr. K. Mackinnon, for the company, said that normally such repayment would be to preference shareholders, but the present repayment was with the consent of the preference shareholders, whose dividend was to be increased from 4½ per cent. to 6 per cent. Also, in future, the ordinary capital could be reduced up to £810,000, without the consent, as a separate class, of the ordinary shareholders.

When the Coal Nationalisation Act came into force the company expanded other sides of its business in which it invested compensation money received. There was due from the Coal Board £217,000, and further compensation for other assets had not yet been determined.

Use of Oxygen in Indian Steelworks

During his presidential address to the Indian Institute of Metals at the sixth annual general meeting in Calcutta, Phiroz Kutar, after discussing some of the raw-material problems of the Indian iron and steel industry, referred to the use of oxygen in steelmaking, pointing out that for its successful utilization in the open-hearth furnace, the first essential requirement was the availability of cheap tonnage oxygen. Unfortunately, the capital outlay required for such an installation was high. The price at which oxygen was available in India was about Rs. 20 per 1,000 cub. ft., which was more than ten times the price at which it was made available in Germany. In spite of this high cost, the use of oxygen at Jamshedpur had been adopted and its use would continue.

Montreal's Industrial Equipment Show

British manufacturers are invited to participate in the fourth Montreal Tool and Industrial Equipment Show, described as the production equipment show of Canada, which, sponsored by the Foremen's Club of Montreal and with the co-operation of other industrial organizations, will be held in the exhibition building, Show Mart, Montreal, from November 9 to 13. An attendance of some 25,000 management and production executives is expected. Total floor space to be occupied is 80,000 sq. ft. Combined with the show is the Montreal Materials Handling Show.

Exhibition offices are at 4585, Sherbrooke Street West, Montreal, Quebec.

Dust Control on Floor Grinders

Adoption of Improved Dust-control Principles

Several member firms of the Ventilating Committee of the Foundry Trades' Equipment & Supplies Association, Limited, have redesigned their floor grinding machines to give effect to improved dust-control principles established by the British Steel Castings Research Association,* and one of them† has sent the following description of their range of patented high-speed "Twin Drive" machines illustrated in Figs. 1 to 4.

Three Modifications

The first and most important requirement consists in the closure of the gap between the front and the underside of the normal work rest and the top of the guard side-plates below it. This is effected by a special work-rest unit, shown in Fig. 1, with the rest in the normal position, and in Fig. 2 with a wheel worn down to 20 in. dia. Attached to the rest is a heavy fabricated-steel shroud, having side and front extrusions, enclosing the unavoidable gap below the rest. This shrouding is automatically adjusted by spring loading and accommodates both allowance for wheel wear and work height, as rearrangement of the latter is often necessary when grinding large castings. As the rest must, for safety, always be adjusted close to the wheel, direct extraction at this point is not possible, and since serration of the front of the rest, as mentioned in the preliminary report, would make wheel dressing impossible, extraction is assisted through having a series of holes in the renewable wear-plate, shown on the top of the rest.

The second requirement is satisfied by the provision of extensions of the existing side-baffles, so as to close completely the gap between the sides of the wheel and the inside faces of the guard side-plates. The baffles below the rest are, however, turned downwards, to act as a funnel and so collect dust which tends to spread to either side. This baffling is shown in Fig. 3.

The third requirement calls for the closure at all times of the gap at the top between the adjustable nose-piece and the periphery of the wheel, and the adjustment of this member must be possible without the aid of a spanner, so that the operator can be made responsible for preventing leakage of dust at this point. In addition, the strength of the nose-piece must be maintained to ensure safety for the operator. This requirement is fulfilled and is also shown in Fig. 3, in which the side wings can be seen obstructing the slot in the guard side-plate, whilst the hand lever is removed, as it is for wheel replacement.

Proving Tests

The three improvements described have been shown, by means of photography with high-intensity lighting, to deal with a high percentage of the lighter dust, without in any way complicating the machine or interfering with the normal methods of operation. Efforts to increase the efficiency still further only result in complication and obstruction to the operator, and with very little beneficial effect.

* These principles have been demonstrated in the British Steel Castings Research Association film No. 39/53/S7 shown to the annual conference of the Institute of British Foundrymen in Blackpool on June 18. The film is available on loan, on application to the Association at Broomgrove Lodge, Sheffield, 10.

† F. E. Rowland & Company, Limited, Climax Works, Reddish, Near Stockport

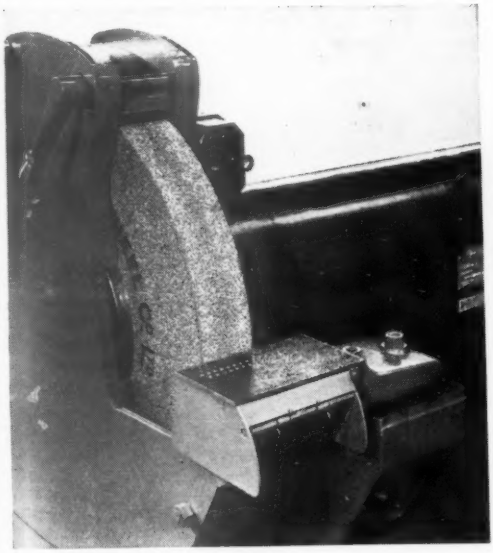

FIG. 1.—*Floor Grinder using a New* 30*-in. dia. wheel, and fitted with the Newly-designed Tool Rest, in the Normal Position.*

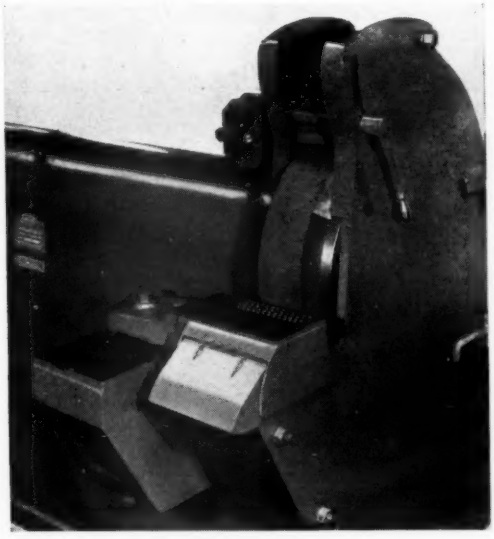

FIG. 2.—*Similar Grinder to that of Fig.* 1, *but with a Wheel worn down to* 20 *in., and the Tool Rest adjusted to suit.*

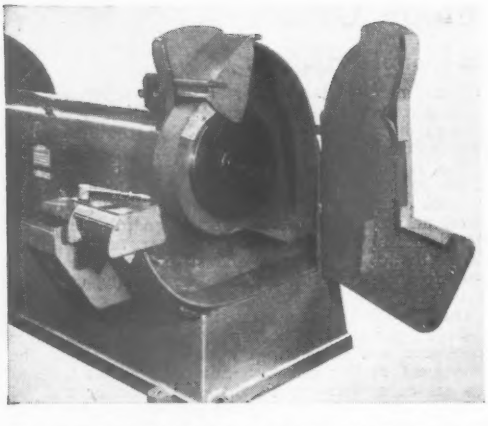

FIG. 3.—*Re-designed Floor Grinder, with the Wheel Housing exposed to show the Baffling Arrangement.*

Founders will be able to purchase sets of this patented equipment for conversion of existing machines of the firm's manufacture, so enabling users to bring their grinders up to standards required to satisfy modern industrial hygienic precepts.

The machine illustrated is the 30-in. size of the range of three models standardized, all of which incorporate independent drive by separate standard-type, totally-enclosed motors, three separate speeds with individual safety overspeed devices, also a compulsory speed-change equipment. This method compels the operator to maintain the maximum permissible speed at all times. The collet-type of wheel mounting is as necessary in these machines as it is with precision grinders.

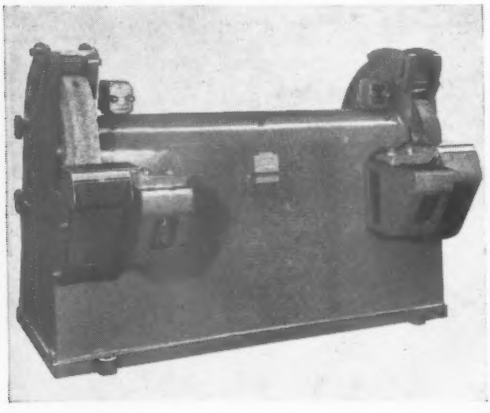

FIG. 4.—*General View of the Double-ended Grinder, with the Modified Dust-extraction System.*

ROCHDALE EDUCATION COMMITTEE is setting up a 12-member advisory engineering committee, and has asked local engineering employers and employees to submit names from which four from each side can be chosen.

House Organs

The Nickel Bulletin (May). Issued by the Mond Nickel Company, Limited, Sunderland House, Curzon Street, London, W.1.

This issue carries a data sheet giving the magnetic properties of nickel/iron alloys and the usual abstracts of technical articles. It is available to our readers on writing to Curzon Street.

Bradley's Magazine No. 54. Published by Bradley and Foster Limited, Darlaston, S. Staffs.

This number contains a nice historical article on "Ironfounding in the Midlands," some well-chosen abstracts—one of which shows a really broadminded attitude on the part of the Editor—and prints an article on the spectroscopic analysis of tin.

Foseco Foundry Practice, No. 110. Issued by Foundry Services Limited, Long Acre, Nechells, Birmingham, 7.

Here is described a case where turbulent founding resulted in a faulty aluminium-alloy casting; a second article tells of the effect of phosphorus on bronzes whilst the third deals with the subject of patternmaking practice for steel castings.

Tin and Its Uses, June, 1953. Issued by the Tin Research Institute, Fraser Road, Greenford, Middlesex.

This issue is quite interesting for foundrymen as there is an illustrated article on the mass production of small bells by the shell-moulding process at a Croydon bell foundry. A second article covers the subject of "New Aluminium/Tin Bearing Alloys."

Newsletter, July. The house organ of the David Brown group of companies.

This magazine prints an account of the annual gala, the major trophy of which was won by the smallest group—the foundry. This was due not to the moulders, coremakers and fettlers, but to a progress clerk, Miss Gloria Goldsborough, whose prowess at running has placed her in the championship class. Most of this publication deals with sport.

Aluminium News. May, 1953. Issued in Great Britain by the Aluminium Union, The Adelphi, Strand, London, W.C.2.

The reviewer was interested by two paragraphs, the first of which relates the difficulties of high-tension wires in Africa being fouled by "these animated sky-scrapers" or otherwise giraffes. The second tells of the sales resistance to aluminium "engined" watches on account of their light weight. This house organ always has some quite interesting matter and bright ideas for increasing the sale of aluminium.

Bulletin of the Association of Bronze and Brass Founders No. 33. Published from 69, Harborne Road, Edgbaston, Birmingham, 15.

An interesting feature of this bulletin is the printing of the American Non-Ferrous Founders Society's Terms and Conditions of Sale, which have been agreed by the American National Association of Purchasing Agents. The main difference between the British and American is due to the fact that the supply of patterns together with full equipment including core carriers is undertaken by the customer, as but few American foundries have their own patternshops. As for the balance it represents just the type of information essential to the proper conduct of a non-ferrous foundry.

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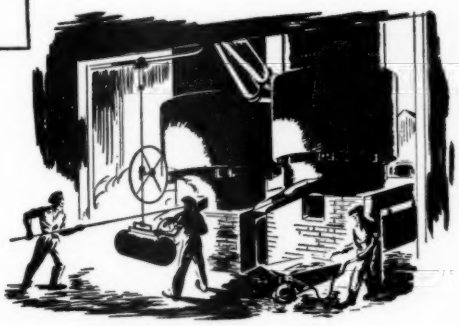

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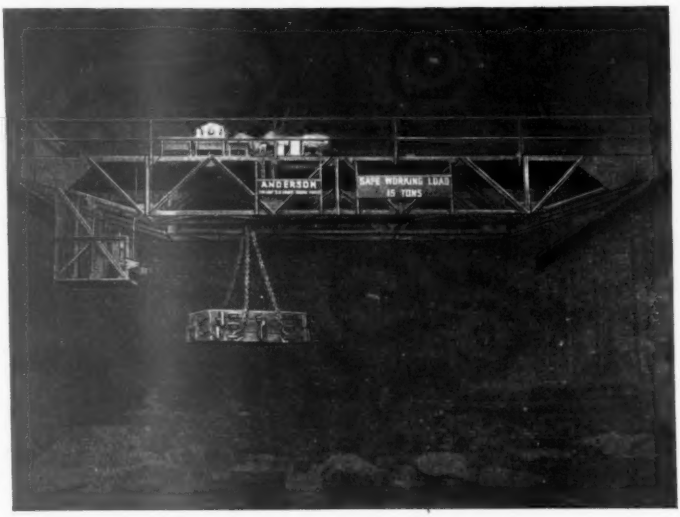

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Fuel Efficiency

There would be changes in the organization for fuel efficiency carried out by the Ministry of Fuel and Power, and there was a proposal for a new non-profit-making company, but the position of the advisory councils and committees was quite separate, and he had not made a decision on the matter, said MR. GEOFFREY LLOYD, Minister of Fuel and Power, answering questions on fuel efficiency last week.

He told Mr. Palmer that he had no powers to impose a levy on privately-owned industry to supplement the sums proposed to be found by the publicly-owned coal, electricity, and gas industries in his financial arrangement for the establishment of the independent fuel efficiency advisory company recommended by the Pilkington committee. He preferred to rely on fees and voluntary contributions.

He agreed with MR. NOEL-BAKER that his department's fuel efficiency service had done good work, but it had been decided that the best vehicle for this was the new fuel efficiency non-profit making company.

Generating Station Capacity

The aggregate installed capacity of the British Electricity Authority's generating stations at June 30, 1953, was 17,490 megawatts, compared with 16,020 mw. up to June, 1952, and 14,760 mw. up to June, 1951. The programme up to March 31, 1954, was about a further 1,300 to 1,400 mw. The increase in plant this year was expected to be considerably more than the increase in demand from all causes.

Giving this answer to a question from MR. GERALD NABARRO, the MINISTER OF FUEL AND POWER said that the question of reverting to the arrangements made in 1951 for a load spread of at least 20 per cent. of industry in the forthcoming winter was being considered carefully.

MR. OSBERT PEAKE, the Minister for National Insurance, stated that he hoped to be able to announce shortly what action he proposed to take on the recommendations of "a very full report" just received from the Industrial Injuries Advisory Council on the cover to be provided for pneumoconiosis.

LICENCES for the construction of 14 ships totalling 86,390 gross tons were issued to Clyde shipyards in the first six months of this year, as compared with 43 ships totalling 336,049 tons in the same period of 1952. The cancellation of one ship of 11,000 gross tons and of value approximately £750,000 was notified to the Admiralty during June.—The First Lord of the Admiralty.

THE MINISTER OF FOOD, Major the Rt. Hon. Gwilym Lloyd-George, M.P., announced in a written reply to a question in the House of Commons last Friday that Government control of starch, starch products and glucose will end on September 27 when the manufacture, distribution and sale of starch, starch products and glucose will be free of all restrictions. As a precautionary measure, however, the Starch and Dextrine (Control) Order, 1943, will not be revoked immediately after September 27. [The Ministry of Food points out that traders should not enter into commitments on the basis of this statement until the announcement of the import licensing procedure by the Board of Trade in the form of a Notice to Importers. The Ministry expects to have a moderate stock of maize starch on hand at the end of September, sufficient to bridge any gap there may be.]

Steel Output Record for June

Although steel output in June was affected by the Coronation holiday as well as by normal holidays, the highest rate ever recorded for the month was achieved, with a weekly average of 337,700 tons, according to figures issued by the British Iron and Steel Federation. The previous highest rate of output recorded in June was last year, when the average was 312,500 tons.

The actual total output of steel in the first half of 1953 was 9,037,700 tons. This is the highest production in any half-year, and compares with 8,023,000 tons in the first half of 1952, an increase of more than 1,000,000 tons.

This gives an annual rate of 18,074,000 tons, which is over 2,000,000 tons higher than last year, when the annual rate was 16,046,000 tons.

Pig-iron output is also running at a higher rate than last year. The weekly average for June was 210,600 tons a week, compared with 199,700 tons a week in June, 1952.

Latest steel and pig-iron output figures (in tons) compare as follow with earlier returns:—

—	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1953—May	214,700	11,165,000	350,700	18,236,000
June ..	210,600	10,949,000	337,700	17,559,000
1st half year	213,500	11,102,000	347,600	18,074,000
1952—May	201,100	10,456,000	312,400	16,245,000
June ..	199,700	10,384,000	312,500	16,252,000
1st half year	199,900	10,397,000	308,600	16,046,000

New School Moulding Shop

A new moulding shop for apprentices attending Burnbank Foundry Trades Centre at Falkirk is to be provided by Stirling County Education Committee. At a meeting of the joint advisory committee of the Centre, the county architect submitted plans for the new moulding shop which it was proposed should be erected at the south end of the existing main building to form a wing extending to the west. He explained that the building would have walls of 9-in. brick, with a pitched roof of steel trusses covered with corrugated asbestos sheeting, roof lights and ventilators. The floor of the building would be 45 ft. long by 27 ft. wide, and it was estimated that the total cost of the construction would be £2,000. The joint advisory committee went over the plans and amended the layout with regard to the disposition of certain of the items of equipment. Thereafter they agreed to recommend that the moulding shop be erected in accordance with the plans submitted, amended to show the revised lay-out, at the cost estimated.

THREE RECORDS in iron production were achieved at the Appleby-Frodingham Steel Company branch of United Steel Companies, Limited, at Scunthorpe in the first week of July. Output from No. 9 blast furnace totalled 6,090 tons, compared with a previous weekly record of 5,760 tons set up five weeks ago. Output from all the company's plants was at a total weekly rate of 21,340 tons, 140 tons more than during the previous record week in May. The company's South Ironworks also achieved a record of 11,110 tons.

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FS/14

Pig-iron and Steel Production

Statistical Summary of May Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activity during the previous six months. Table II gives production of steel ingots and castings in May, and Table III, deliveries of finished steel in April, 1953. Table IV gives the production of pig-iron and ferro-alloys in May, 1953, and furnaces in blast. (All figures weekly averages in thousands of tons.)

TABLE I.—*General Summary of Pig-iron and Steel Production.*

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (all qualities). Imports.[2]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[3]
1951	284	170	206	186	175	8	301	244	585
1952[4]	306	190	228	202	171	29	310	252	739
1952—December[1] ..	296	189	227	206	166	26	314	245	739
1953—January	325	199	234	214	188	25	346	279	770
February	328	194	234	214	193	19	352	272	770
March[1]	334	197	237	216	194	23	351	261	804
April	319	189	242	213	189	20	349	268	868
May	319	198	243	215	190	19	351	—	903

TABLE II.—*Production of Steel Ingots and Castings in May*, 1953.

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants and Essex ..	—	4.2	10.6 (basic)	1.6	0.2	15.6	1.0	16.6
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.7	22.5	—	1.7	0.6	25.3	1.2	26.5
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	38.7	—	—	0.1	38.7	0.1	38.8
North-East Coast	2.2	64.5	—	1.3	0.6	66.6	2.0	68.6
Scotland	4.5	40.9	—	1.7	0.8	45.7	2.2	47.9
Staffs., Shrops., Worcs. and Warwick	—	17.3	—	1.2	0.7	17.5	1.7	19.2
S. Wales and Monmouthshire	6.4	66.0	5.9 (basic)	1.0	0.1	78.7	0.7	79.4
Sheffield (incl. small quantity in Manchester) ..	9.1	27.6	—	9.0	0.5	44.1	2.1	46.2
North-West Coast	0.6	1.3	5.1 (acid)	0.4	0.1	7.4	0.1	7.5
Total	24.5	288.0	21.6	17.9	3.7	339.6	11.1	350.7
April, 1953	24.2	280.5	22.5	17.7	3.6	337.9	10.6	348.5
May, 1952	24.7	244.3	21.3	18.2	3.9	301.1	11.3	312.4

TABLE III.—*Deliveries of New Non-alloy and Alloy Finished Steel.*

Product.	1951.	1952.[4]	1952. April.[1]	1953. March.[1]	1953. April.
Non-alloy steel :					
Ingots, blooms, billets and slabs[5]	4.0	4.5	4.5	5.4	5.4
Heavy rails, sleepers, etc.	10.1	9.8	9.7	10.7	10.6
Plates, ¼ in. thick and over ..	41.0	41.4	41.4	45.8	46.0
Other heavy prod.	39.9	39.0	39.6	42.8	44.6
Light rolled prod.	46.7	46.0	44.4	52.5	54.4
Wire rods	15.9	15.9	15.2	16.5	16.1
Bright steel bars ..	6.5	6.5	5.9	7.6	7.3
Hot rolled strip ..	19.5	18.8	18.5	20.7	18.9
Cold rolled strip ..	6.0	6.1	6.0	4.9	4.7
Sheets, coated and uncoated ..	30.4	31.6	31.2	32.3	32.4
Tin, Terne and blackplate ..	13.8	16.0	16.2	13.8	15.5
Steel tubes and pipes	20.3	20.1	19.8	19.7	20.7
Tubes, pipes and fittings ..	0.5	0.4	0.5	0.3	0.4
Mild wire	11.6	12.2	12.3	11.0	10.9
Hard wire	3.5	3.6	3.1	3.6	3.7
Tyres, wheels and axles	3.7	3.5	3.7	4.2	4.0
Steel forgings (excl. drop forgings) ..	2.3	2.8	2.6	3.3	3.4
Steel castings ..	3.8	4.2	4.4	4.2	4.2
Tool and magnet steel	[6]	0.3	0.3	0.3	0.3
Total	279.5	282.7	279.3	299.6	303.5
Alloy steel	11.4	13.7	12.8	15.1	15.2
Total deliveries from U.K. prod.[6] ..	290.9	296.4	292.1	314.7	318.7
Add : Imported finished steel ..	5.8	13.8	11.8	6.2	6.3
	296.7	310.2	303.9	320.9	325.0
Deduct : Intra-industry conversion[7] ..	55.0	60.2	59.6	61.9	59.1
Total net deliveries ..	241.7	250.0	244.3	259.0	265.9

TABLE IV.—*Production of Pig-iron and Ferro-alloys during May*, 1953.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total
Derby, Leics., Notts., Northants and Essex	26	—	18.6	25.2	0.9	—	44.7
Lancs. (excl. N.W. Coast), Denbigh, Flints, and Cheshire ..	8	—	14.1	—	—	1.3	15.4
Yorkshire (incl. Sheffield, excl. N.E. Coast) ..							
Lincolnshire ..	13	—	31.3	—	—	—	31.3
North-East Coast	24	4.4	42.6	—	—	1.4	48.4
Scotland	8	0.8	14.0	1.5	—	—	16.3
Staffs., Shrops., Worcs., and Warwick ..	7	—	6.1	1.6	—	—	7.7
S. Wales and Monmouthshire	9	3.8	30.6	—	—	—	34.4
North-West Coast	6	16.5	—	—	—	—	16.5
Total ..	101	25.5	157.3	28.3	0.9	2.7	214.7
April, 1953 ..	103	24.8	154.9	28.6	1.4	3.0	212.7
May, 1952 ..	101	26.6	140.6	29.4	1.6	2.8	201.1[9]

[1] Five weeks, all tables.

[2] Weekly average of calendar month.

[3] Stocks at the end of the years and months shown.

[4] Average 53 weeks ended January 3, 1953.

[5] Other than for conversion into any form of finished steel listed above.

[6] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[7] Material for conversion into other products also listed in this table.

[8] Included with alloy steel.

[9] Including 100 tons direct castings

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News in Brief

A. REYROLLE & COMPANY, LIMITED, have appointed Mr. James Bennett, contracts manager, to be a director of the company.

PRINCE-SMITH AND STELLS, LIMITED, textile-machinery makers, Keighley, have appointed MR. JOSEPH HENRY CALEY to be sales director.

ROLLS-ROYCE, LIMITED, have appointed Lord Hives as chairman and joint managing director for a further period of five years, from the beginning of this year. He is 67.

FOR THE FIRST TIME since the war there will be official British Government participation in the Canadian National Exhibition, which is to be held in Toronto from August 28 to September 12, 1953.

BRITISH INSULATED CALLENDER'S CABLES, LIMITED, announce that with effect from August 1, the address of their Exeter branch office will be 40, Whipton Village Road, Whipton, Exeter, telephone Exeter 67308.

AS THE GUEST of the English Electric Company, Limited, a visit was paid to Bradford by Mr. Munilal Mehra, an important Indian industrialist, who expects orders worth £4½m. to be placed with British firms within the next 12 months.

GUY MOTORS, LIMITED, Wolverhampton, have completed extensions to its Fallings Park factory, designed to accommodate the transfer of the Sunbeam Trolley Bus Company from Villiers Street, and to cope with the increased demand for Guy buses.

FIRST-FLOOR OFFICE PREMISES were completely burned out and two men were injured when fire damaged thhe factory of Richard Berry & Son, of Alma Street, Aston, Birmingham, on July 13, but production was not affected. The cause of the outbreak is not known.

AN IMPORTANT ORDER for electrical equipment for what will be the fastest mill in Great Britain for rolling tinplate strip has just been placed with the British Thomson-Houston Company, Rugby. This is for the new plant at Velindre, near Swansea, of the Steel Company of Wales, Limited.

MATTHEW BOULTON PLATE, including a chimney-piece garniture made by Boulton, which has been lent from Windsor by the Queen, is included in an exhibition which opened at Birmingham Art Gallery on Saturday, July 18 until September 6. The Princess Royal has also lent some historic pieces. The exhibition is to celebrate Coronation Year.

THE OFFICIAL VISIT of the Institute of British Foundrymen to the Engineering, Marine and Welding Exhibition organized by F. W. Bridges & Sons, Limited (to be held at Olympia, London, from September 3-17 inclusive), will take place on September 7. The Institute of Vitreous Enamellers are paying their official visit on September 16.

THE ANNUAL "Family Visit" to the G.E.C. Witton Works,, Birmingham, has lost none of its popularity and recently some ten thousand visitors toured the various workshops and laboratories on the Witton Estate. To commemorate the Coronation, each visitor was presented with a metal bookmark which was produced on one of the presses in the works.

A POLARISCOPE was demonstrated recently in Dundee Technical College and it was suggested there is something here worthy of study by all industries concerned in the stresses that machinery has to bear. The principle is that a model of part of a machine to be designed is made in transparent plastic and then placed in the polariscope for photo-elastic analysis.

A MOBILE SHOWROOM is being used with considerable success throughout the Midlands area by Rowe Bros. & Company, Limited, of Birmingham, builders' merchants and canteen-equipment specialists. The body of a 50-cwt. "Morris Commercial" van has been specially modified to provide a setting for displays of the firm's goods, giving potential customers a showroom service direct to their doors.

THE SCOTTISH COUNCIL (DEVELOPMENT & INDUSTRY) has decided to send an industrial mission to Western Canada to investigate the prospects of increasing Scotland's exports to the growing markets in the province of Manitoba, Saskatchewan, Alberta, and British Columbia. The mission, which will be led by Sir Alex. McColl, of the Council's London committee, will spend a month in Canada from September 1.

FROM AUGUST 10, Qualcast, Limited, Victory Road, Derby, will transfer the whole of their lawn-mower production to their works at Sunny Hill, Derby, which they took over in 1949. When this transfer is completed it will create an opening for an entirely new foundry process at the Victory Road works, Derby, which will call for an additional 120 employees. Space will also be available for a second die-casting foundry.

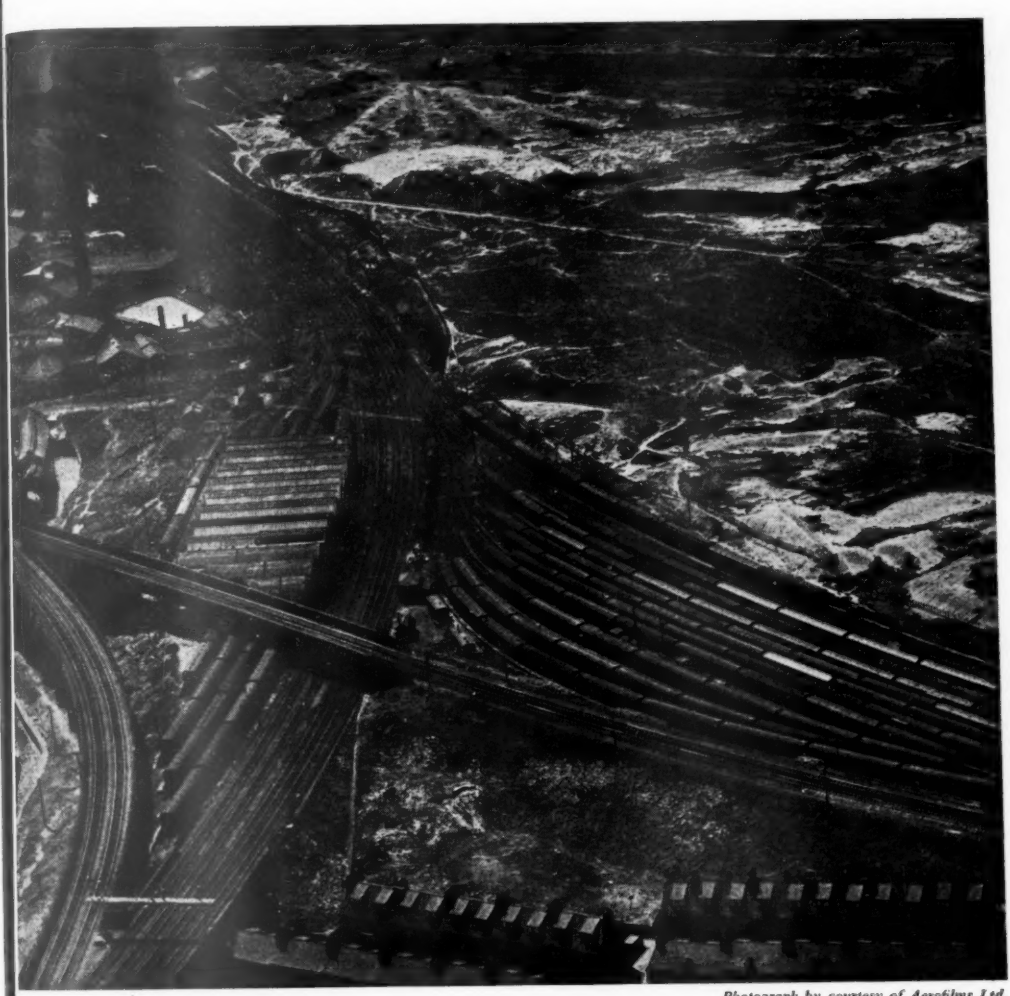
A MEETING was held last Thursday of the Women's Advisory Council on Solid Fuel at which the Hon. Lady Egerton took the chair, at the English Speaking Union, Charles Street, London, W.1. Mrs. D. M. Charlton, B.SC., was elected chairman of the Council to replace the Hon. Lady Egerton, who after 10 years' devoted work, has decided to retire. After the meeting, a small conference was held on "The solid-fuel appliances we need."

AT A MEETING of Bilston Foundries, Limited, held on July 15, the directors resolved to recommend the payment of a dividend of 20 per cent.—less income tax—on the two-shilling ordinary shares for the year ended March 31, 1953. This dividend is at the rate which was anticipated when the shares were introduced on the Birmingham Stock Exchange in November, 1952. The net profit of the company for the year ended March 31 amounted to £108,530, subject only to taxation, as compared with £103,732 for the previous year.

THE ANNUAL MEETING of the Guardians of the Standard of Wrought Plate was held in Birmingham on July 11, Lt.-Col. R. A. Wiggin presiding. The following were elected wardens for the ensuing year: Lt.-Col. Wiggin and Mr. W. H. Newton, Mr. A. J. Christie, and Mr. R. S. Darby. Three vacancies among the guardians were filled by the Viscount Cobham, Mr. K. W. Grimsley and Mr. D. H. Wright. A serious decline in the silver business was reported. No substantial or lasting improvement in the trade could be expected, it was pointed out, while purchase tax on gold and silver articles remained at 75 per cent.

A REMARKABLE PIECE of repair work has been carried out in the course of the past fortnight at the railway wagon works of Charles Roberts & Company, Limited, Horbury Junction, near Wakefield. The table for a 250-ton press—a 16-ton iron casting—had broken into two pieces during the re-siting of the press, which is an important part of equipment required for use in connection with a new railway tanker contract for Rhodesia. To have made a new iron table would have not only cost something like £3,000,

(*Continued on page* 132)



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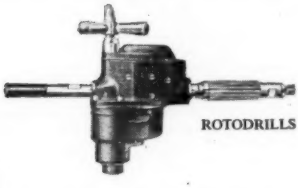

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News in Brief

but would have also taken quite a time. It was repaired by the "Metalock" process.

SIX WEEKS after despatching Britain's heaviest road load—a 165-ton steel casting—the English Steel Corporation, Sheffield, has despatched a still bigger casting weighing 185 tons, the first of a number of the same size which are being sent to America to be built into a huge press in connection with that country's defence programme. Over 500 tons of sand were used in making the mould in a pit 32 by 18 by 12 ft. and 232 tons of liquid steel were required to fill the mould for the casting. This huge casting is being transported by road to Liverpool, for shipment, *via* Huddersfield, Oldham and Manchester, on a 60-ton trailer, with a police escort all the way. The casting was expected to reach the port in four days.

A MODEL made by Mr. Broun-Morison is to have a place of honour in the archives of the Mond Nickel Company. It captures the historic moment when Dr. Ludwig Mond made his discovery of nickel carbonyl, in 1888. Mond's discovery interested Henry Wiggin & Company and an arrangement was made whereby part of the Wiggin land at Smethwick was loaned to Mond and his colleague Dr. Langer for experimental work. As a result, the first carbonyl-refined nickel produced on an industrial scale came from a model plant, built at Smethwick in 1892. To house the model plant, Dr. Mond built a pitch-pine shed. By 1895, the major technical difficulties had been overcome and 1898 marked the formation of the Mond Nickel Company, Limited.

SEVEN YEARS AFTER its initiation by Professor M. L. E. Oliphant, Birmingham University's giant proton-synchrotron—the largest in Europe, with a weight of nearly 100 tons—is undergoing its first tests. Announcing this fact, Professor P. B. Moon said that the machine, a successor to the cyclotron, is used entirely for industrial and scientific research. Only in America is there a larger machine. Most of the cost of the machine has been met by the Department of Scientific and Industrial Research and the Nuffield Foundation. By bombarding atomic nuclei with protons, derived from hydrogen gas, the machine breaks up atoms. The protons are given an electrical impetus each time they pass round the 100-ft. long chamber. At present they have made 1,000,000 revolutions giving them an energy of approximately 250,000 v., or half the speed of light. In time, they will achieve 90 per cent. of the speed of light, but no one would be able to say when that would take place.

EACH OF SEVEN EMPLOYEES having at least 50 years' service with W. & T. Avery, Limited, received a note for £50, tax free, at the company's Soho Foundry, Smethwick, on July 13. The occasion was the annual presentation of long-service awards by Sir Walford H. Turner, chairman. Twenty-nine other employees, each with more than 40 years' service, received gold watches. Service covered by these awards totals 1,510 years, bringing the total for which awards have been made since 1942 to 14,250 years—113 awards to men with at least 50 years' service and 215 awards to employees with more than 40 years' service. Among recipients on July 13 was Mr. J. T. Burford, general works manager, who joined the firm as an apprentice in November, 1902. A long-standing family link with the firm was broken on Friday, when 65-year-old Mr. William Henry Howell, of Smethwick, retired after 52 years' service. He, his father, and grandfather served the firm for 157½ years. Mr. Howell was presented with an electric fire by his colleagues in the jig and tool drawing office.

Personal

MR. E. HUNTER, F.I.M. (Incandescent Heat Company, Limited), has changed his home address to 22, Woodthorne Road, Tettenhall, Staffs.

MISS HILDA DANN, forewoman over the core shop at Ruston & Hornsby, Limited, was the recipient of several presents to mark 25 years' employment with the firm. The presentations were made by Mr. R. C. Shepherd.

AFTER NEARLY 17 YEARS as president of the British and Latin American Chamber of Commerce, SIR PATRICK HANNON has retired. He has been appointed an honorary vice-president and remains a member of the Chamber's council. The new president is MR. MICHAEL LUBBOCK, a director of the Bank of London and South America.

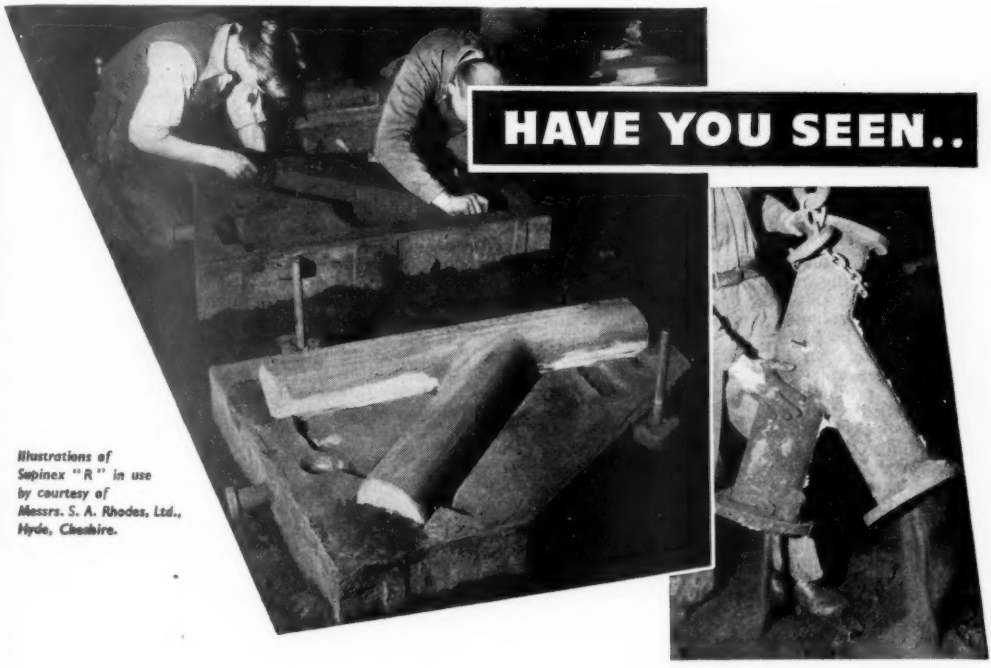
MR. DONALD J. REESE, who is in charge of the foundry activities of the Research and Development Division of the International Nickel Company of New York, together with Mrs. Reese, is now in this country on a combined business and holiday trip. He will participate in the International Foundry Congress in Paris next September.

AFTER A LIFETIME of work with the United Steel Companies, Limited, MR. ROBERT SIMPSON retired last week from the secretaryship of the Cumberland group. Mr. Simpson joined the Moss Bay Hematite Iron Company, Limited, one of the predecessors of the United Steel Companies in Cumberland, in 1902. Twenty-four years later he was appointed secretary and accountant of the Workington Iron & Steel Company branch of the United Steel, having been closely concerned with the formation of the company.

THE EXECUTIVE DUTIES of chief electrical engineer of the British Thomson-Houston Company, Limited, were relinquished recently by MR. HUGH MCC. JACK, who was appointed to the position in 1945. He had specialized in alternating-current plant of advanced design in his association with B.T.-H., which began in 1908, and is to continue, since Mr. Jack retains his seat on the Board to which he was elected in March, 1946. Mr. Jack is succeeded by his chief assistant, Mr. G. S. C. Lucas, who at the same time is appointed a director.

FOR HEALTH REASONS, the manager of the Govan shipyard, Glasgow, of Harland & Wolff, Limited, MR. LOUIS V. DUNLOP, has retired and has had also to resign from the Board, to which he was elected in 1943. He is succeeded by the present assistant manager, MR. CHARLES SIMPSON. Mr. Dunlop has served the shipbuilding industry for nearly 60 years, starting work at the Greenock yard of Caird & Company. Shortly before that company was taken over by Harland & Wolff in 1915, he became shipyard manager, a position he retained. In 1928, he transferred to the Glasgow yard as manager.

AT THE ANNUAL GENERAL MEETING of the British Internal Combustion Engine Research Association, Viscount Falmouth, C.I.E.E., M.I.MECH.E., was re-elected president and Air Commodore F. R. Banks, C.B., O.B.E. (principal director of Engine Research and Development, Ministry of Supply), Dr. S. F. Dorey, C.B.E., M.INST.C.E., M.I.MECH.E. (chief engineer surveyor, Lloyd's Register of Shipping), and Lieut.-General Sir Frederick G. Wrisberg, K.B.E., C.B., were re-elected vice-presidents. Vice-admiral (E) F. T. Mason, C.B. (Engineer-in-Chief of the Fleet), Major-general H. R. B. Foote, V.C., C.B., D.S.O. (director-general, Fighting Vehicles Division, Ministry of Supply), and Sir Harold Roxbee Cox, PH.D., D.I.C., M.I.MECH.E. (chief scientist, Ministry of Fuel and Power), were also elected vice-presidents.



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Raw Material Markets

Iron and Steel

Except in the case of the engineering foundries catering for the motor vehicle trades, from whom a slightly increased demand for castings has recently been forthcoming, and the foundries which supply collieries, steelworks, and machine-tool makers, business is slow in the foundry trade. Many of the light and textile foundries and some of the jobbing foundries are unable to improve on their present position, which necessitates short-time working. Mechanization measures undertaken by many firms during the boom period naturally require a proportionate increase in business to keep plants operating to capacity, but a much larger volume of business than that now available is required for this to be accomplished.

The demand for high-phosphorus pig-iron from the textile, light, and jobbing foundries has declined considerably; producers have little difficulty in supplying the specified quantities. Current deliveries of low- and medium-phosphorus irons are just about sufficient to meet the needs of the engineering and speciality foundries, most of which are keen to add to their order-books, particularly for forward delivery. Some producers still find it necessary to distribute supplies very carefully. Deliveries of hematite from home furnaces are inadequate, although demands are reduced.

The foundries are able to obtain their full requirements of scrap, as well as ample supplies of foundry coke, ganister, limestone, and firebricks.

Lack of export orders is the main handicap to the re-rollers of small bars, sections, and strip, whose home trade continues to weaken, with the result that many units are working below capacity. Unfortunately, current U.K. prices are too high to attract oversea orders. The sheet re-rollers are short of orders, particularly for the narrower gauges, large stocks of which are on hand at producing points.

Non-ferrous Metals

While lead and zinc both scored small advances last week, the tin market again sagged rather badly. The outlook for tin is certainly not bright, for consumers are doing very little, buying on a hand-to-mouth basis. In the U.K., usage has declined of late and recent months have shown the figure a long way below 2,000 tons. In the United States the corresponding figure is about 5,000 tons monthly, but both in this country and in America consumers are running down their stocks. From the point of view of the Metal Exchange and of those who wish to hedge against length, the increase in stocks in official warehouses from a little over 500 tons to about 1,660 tons in the course of one week is a satisfactory development, for it has banished the backwardation which persisted for so long. Trading in both lead and zinc has been rather quiet.

The trade has now had some time to consider the revised standard copper contract and, on the whole, reactions are favourable, although there are aspects of the contract which do not appeal to certain sections of the trade. Producers of rough copper cannot use the contract except for hedging since their product is not a good delivery in accordance with the list of options afforded to the seller. This is something of a hardship, for this grade cannot be freely exported since its sale abroad is subject to licence and there is not an unlimited market for it at home. That electrolytic or high conductivity fire-refined wire bars should have been chosen as the standard quality for delivery on the market is probably a good thing, for it is probable that a considerable tonnage is available in the country. Unfortunately, even the closest study of the contract does not tell the inquirer at what level trading in copper will start on August 5.

To facilitate the private purchase of unwrought, refined, and blister copper in the form of anodes, bars, billets, cakes, cathodes, ingots, ingot bars, slabs, and wire bars, the Board of Trade announces that, as from August 5, open individual licences valid for importation from any source will be granted to members of the London Metal Exchange who participate in the Bank of England exchange control scheme. Applications for these licences will also be considered from consumers and producers' agents who wish regularly to import substantial quantities other than through the medium of the exchange. Applications should be made to the Import Licensing Branch, Board of Trade, 43, Marsham Street, London, S.W.1.

Official tin quotations were as follow:—

Cash—July 16, £582 10s. to £585; July 17, £592 10s. to £595; July 20, £585 to £587 10s.; July 21, £571 to £572; July 22, £572 to £574.

Three Months—July 16, £582 10s. to £585; July 17, £590 to £592 10s.; July 20, £585 to £586; July 21, £570 to £571; July 22, £570 to £572 10s.

The following official zinc prices were recorded:—

July—July 16, £74 15s. to £74 17s. 6d.; July 17, £74 to £74 5s.; July 20, £74 2s. 6d. to £74 5s.; July 21, £74 5s. to £74 7s. 6d.; July 22, £74 5s. to £74 7s. 6d.

October—July 16, £74 17s. 6d. to £75; July 17, £74 5s. to £74 7s. 6d.; July 20, £74 5s. to £74 7s. 6d.; July 21, £74 10s. to £74 15s.; July 22, £74 15s. to £75.

Official prices of refined pig-lead:—

July—July 16, £92 15s. to £93; July 17, £93 10s. to £93 15s.; July 20, £94 15s. to £95; July 21, £94 15s. to £95 5s.; July 22, £94 10s. to £94 15s.

October—July 16, £90 to £90 10s.; July 17, £91 to £91 2s. 6d.; July 20, £91 15s. to £92; July 21, £92 7s. 6d. to £92 10s.; July 22, £92 to £92 10s.

Publications Received

Symposium on Aluminium Alloy Castings. Published by the Aluminium Development Association, 33, Grosvenor Street, London, W.1. Price 4s.

The book is a report of two meetings held at Birmingham and London, at which the same series of eight papers was presented and discussed. These papers were carefully chosen to cover a wide field which resulted in many aspects being discussed. Re-reading the papers and discussion, the criticisms of the industry were both helpful and not at all severe. Price as influenced by the runner and riser ratio was among the important subjects discussed. The booklet is very good value for money.

Elements of Foundry Costing by H. P. Court, F.C.W.A., and W. E. Harrison, F.C.W.A. Published by the Council of Ironfoundry Associations, 14, Pall Mall, London, S.W.1.

From the preface it is learnt that this is the first of a series of eleven pamphlets designed to cover every phase of cost ascertainment. Probably, the most important will be No. 10 "The Cost of Costing." Some years ago, the C.F.A. issued a book "Cost Ascertainment Methods for the Ironfoundry Industry." Apart from the title, which is too academic, the system disclosed is very satisfactory, but it needs "selling." That is just the object of the present series of pamphlets. If the standard of the first one, which is an excellent *hors d'oeuvre*, is maintained, there should be a recrudescence of interest in the subject. Moreover, it will be evident at a time when it is most needed, for with increasing competition cost facts are so much better than the most highly intelligent guesswork.